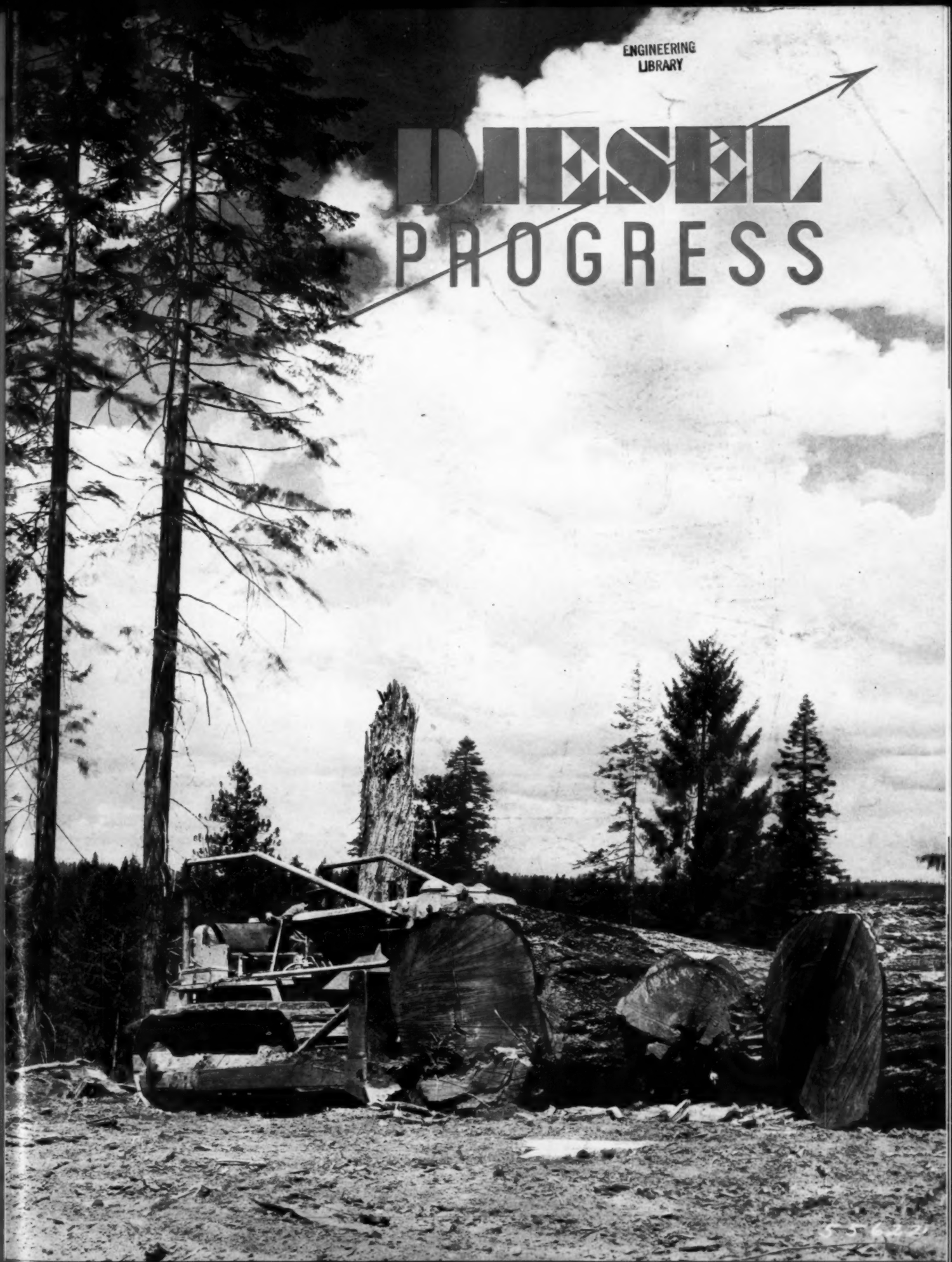
DIESEL PROGRESS



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DIESEL and GAS ENGINE PROGRESS

N INDUSTRY • IN TRANSPORTATION • ON THE SEA • IN THE AIR

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AUGUST 1947

FRONT COVER ILLUSTRATION: Caterpillar Diesel Tractor with bulldozer nozing over a sizeable log on the Palace Lumber Company operation in Yuba County, California. This log of Douglas Fir containing 5200 bd. ft. was skidded out of a 390 ft. canyon—18% grade by the tractor shown equipped with Hyster winch and arch.

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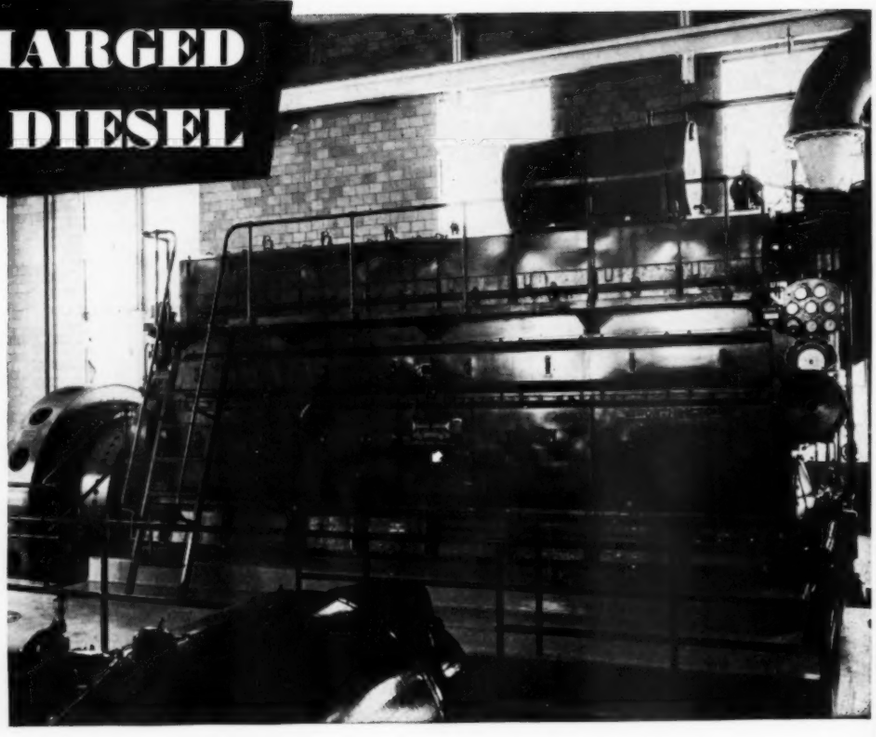
FIRST SUPERCHARGED DUAL FUEL DIESEL

By L. K. CHRISTOLEAR*



View of supercharged dual fuel Diesel shows the control wheel by which the ratio of gas/oil is manually adjusted. Gauges include an Alnor pyrometer connected to thermocouples in each exhaust nozzle, each turbocharger inlet nozzle and one in the discharge of the charger and a midget levelometer giving constant indication of the amount of oil in the fuel oil day tank seen above No. 2 and 3 cylinder valve covers.

LAMAR is located about 30 miles west of the Kansas line, in the lower Arkansas River valley of Southeastern Colorado. It is a rapidly growing western city of 6,000 and the center of a large agricultural and livestock raising area. The prime crops of the "dry land" are wheat and various acclimated row crops with all of the untilled lands used in large blocks for sheep and cattle grazing. Nearly all possible of the land in the valley proper that can be supplied with water through the great systems of canals by gravity from the river, is under irrigation and devoted to sugar beets, alfalfa and other varied crops down to some truck gardening. As markets demand, wheat, corn, and other so-called dry land crops are tilled on the irrigated lands. The area also claims to be the leading turkey producing center of the U. S. The supply of water for irrigation has been "firmed up" by the recent completion of the John A. Martin Dam 17 miles west of Lamar. The reservoir thus created is capable of impounding some 600,000 acre feet of water with about 250,000 acre feet the planned capacity for irrigation, the remaining capacity being held for flood control.

Annual power sales to the alfalfa milling and flour milling industries located in the valley at rail points near the growing areas for a distance of forty miles east and west through the system of the Lamar Municipal electric net work have been in the millions of kilo-watt-hours for many years. Sales to domestic consumers are over 1000 kwh. per year as additional evidence that the system has kept in step with the downward slide of rates to all consumers.

Prior to 1921, Lamar was served inadequately by The Inter-mountain Railway Light & Power Company with a steam plant using coal in hand fired boilers to produce steam to drive reciprocating engine-generator units, some of which were non-condensing. The downtown area was served with both A.C. and D.C. This company supplied energy to a nearby area with a few miles of iron wire line. Because of the poor service and lack of funds the Inter-mountain Company could not modernize its plant and in 1919 the Public Utilities Commission of Colorado authorized the purchase of the existing distribution system as well as the construction of an entirely new generating station by the City of Lamar. Thus, Lamar became one of the first municipally owned and operated systems in Colorado.

The new plant produced its first energy on April 22nd in 1921 and has continued production to date with the exception of several day's forced shutdown when high water of the Arkansas River poured into the plant following the disastrous Pueblo flood of 1922. The equipment installed consisted of two General Electric turbo-generator units, rated 500 kw., 625 kva., 3,600 rpm., 60 cycle, 3 phase, 2300 volts, exhausting into Worthington Pump & Machinery Corporation surface condensers and auxiliary equipment. The boiler plant was made up of three 150 pound boilers of approximately 9,000 pounds steaming capacity per hour. The above turbines were rated at 135 lb. steam pressure, saturated.

The word "dual" is not new to Lamar, for by 1928, load requirements called for additional capacity. This time, also, with coal at a low cost, the new equipment to be added was steam but with many years life still in the original 27,000 pound per hour boiler plant a dual pressure turbine was extremely desirable so that the utilization of the existing low pressure steaming capacity during scheduled maintenance periods without too great a sacrifice of generating capacity would be possible, the prime thought being to take advantage of the greater heat to mechanical energy transfer per pound of steam with steam at 400 lb. psi., superheated to 750 degrees total temperature which was the economical pressure-temperature balance of the chosen size of turbine and additional steam boiler in the late 20's.

The American Brown Boveri Corporation of Camden, New Jersey, offered a turbo-generator unit which best suited the above conditions. This unit, manufactured by the parent company, The Brown Boveri Company, Ltd., Ltd., Baden, Switzerland, rated at 2,000 kw.,

* *Superintendent Electric Department, City of Lamar, Colorado.*

2,500 kva., 3,600 rpm., 60 cycles, 3 phase, 2300/4000 "Y" volts went into service in 1929 and is still in daily use using steam from one bioler unit installed at the same time rated, 25,000 pounds of steam per hour, 400 lb., 750 degrees tt.

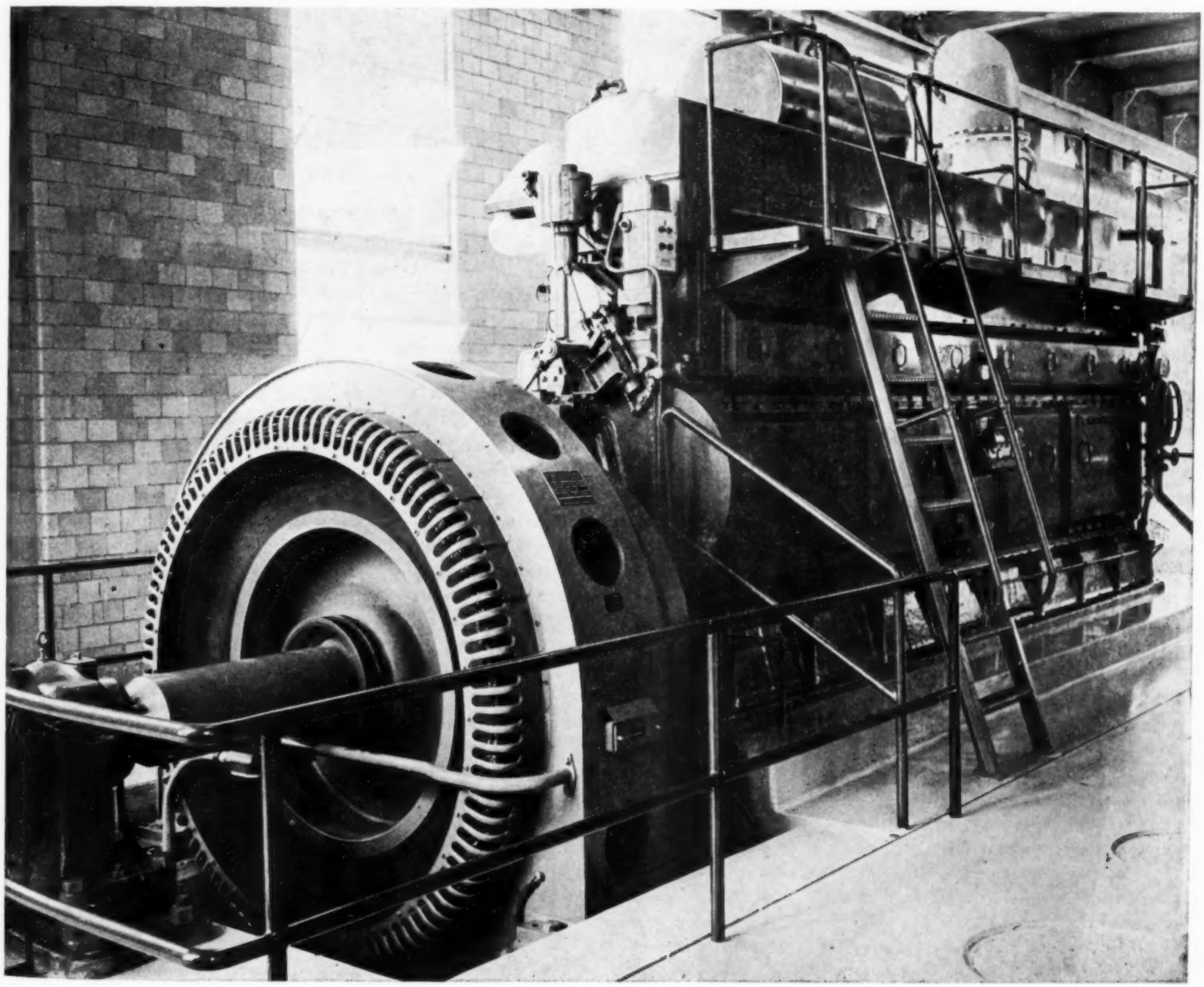
Natural gas was brought to Lamar in 1933. Stokers were discarded and combination gas-oil burners were installed, with 20,000 gallons oil storage for emergency use.

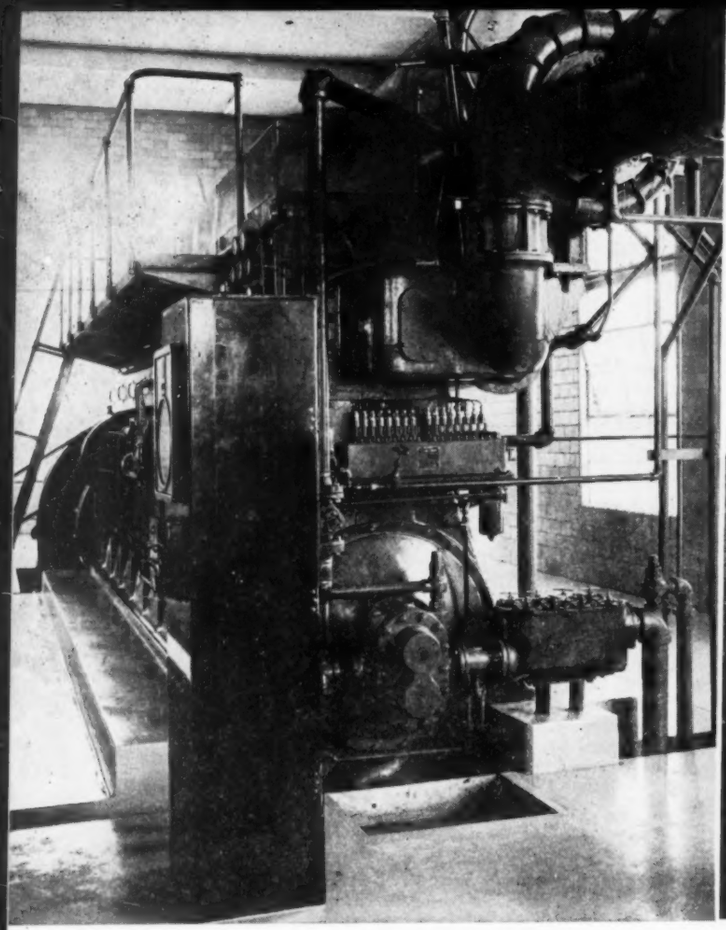
An additional boiler unit, 30,000 lb. steaming capacity with the same conditions along with an additional turbo-generator unit, rated 2,000 kw., 3125 kva. with the same electrical characteristics as the first 2,000 was installed by the Elliott Company in 1939 exhausting into a Worthington surface condenser, bringing the total generating capacity up to but 4,000 kw. since the original boiler plant had been retired due to age and poor efficiency. These three boilers were natural draft and their retirement presented the number one vital problem that faces all isolated steam plants which depend upon motor driven fans for draft. The bulk of other steam plant auxiliaries such as boiler feed pumps, vacuum equipment, etc., installed in 1929 and 1939 are products of Worthington.

In 1940, consideration was given to the use of a small engine driven generator unit to provide emergency power for forced and induced draft plus other minor auxiliary apparatus found in the steam plant when and if the need arose through the failure of steam from any cause which might occur in any plant. About 200 kw. would be needed to safely "get on the line" after a total steam plant outage. This plan was not carried out because of World War Two which brought on sufficient additional load that the boiler plant was on 100% demand most of the war years. This increase became the source of another vital problem.

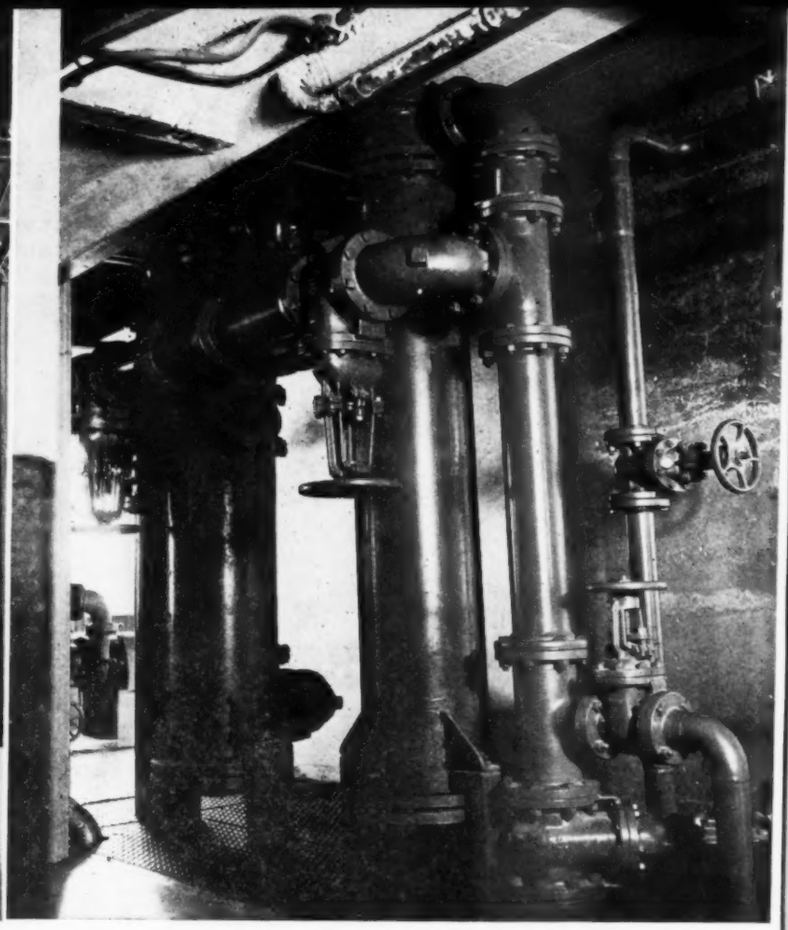
As in many western regions, the domestic water supply has at times been limited. Therefore, from the beginning, the Lamar plant has pumped cooling (circulating water for steam condensing) from shallow wells. Because water from this source is virtually saturated, no economical treatment for the precipitation of the scale forming hardness has been found. As a result the water is pumped once through the

Engine operating level is 10 feet above ground floor with the foundation isolated from the building. The American Bosch pilot fuel pump unit may be seen through the platform ladder. Woodward governor, linkage and overspeed trip are directly above flywheel. Manhole covers are located directly above the heat exchangers for convenient use of the traveling crane when removal of tube bundles is necessary. Penflex exhaust tubing is used.





All auxiliaries are remotely controlled by the instrument panel which is equipped with safety alarms by Viking. Built on the engine is the Elliott-Buchi supercharger.



Oil and jacket water heat exchangers by Struthers-Wells are supported on pedestals through the concrete, steel decked pipe trench in which all power piping is located. Badge type joints are installed.

condensers and wasted to the sewer with an average maximum outlet temperature of 58 degrees, approximately 7 to 10 degrees below the critical temperature at which scale will form inside of condenser or heat exchanger tubes. Since the demand for additional cooling water is directly proportionate to the kwh. output, and because the capability of the water producing gravel within one third of a mile radius of the plant was becoming exhausted, the use of the abundance of 85 degree water leaving the steam condensers plus an occasional gas line failure became the foundation for an engineering report by the author to the City Council in 1943 which recommended that careful consideration be given to the installation of a larger engine generator unit than the usual 200 kw. unit used in isolated plants.

An internal combustion engine driven generator unit ranging from 1000 to 1500 net terminal kw. capacity could be capable of serving as a peak load unit, could carry essential loads as domestic water pumps, hospitals, etc., during the warming up of another boiler which takes from 36 to 48 hours in the event of a total steam plant outage, would utilize a small part of the cooling water, unsuitable, as above outlined for further use for steam condensing, saving for quite some time a heavy investment in an additional water supply for the steam plant and above all would fill the need for some emergency source of power during an un-expected gas line failure.

Specifications were written and on July 5, 1945, a contract was awarded the Worthington Pump and Machinery Corporation for a turbocharged engine generator unit which more than filled the above requirements. This engine, an 8 cylinder, 16 x 20 dual fuel type SEHGO-S boasts many of the latest developments in internal combustion engine design. A novel specification was adopted in that the performance and capacity required were in net terminal kw. rather than the usual brake horse power because after all the salable kwh. are the units in which any plant is interested.

The unit operates at 360 rpm. Altitude loss is compensated for by a built-on Elliott-Buchi supercharger utilizing the heat energy of the exhaust gas to deliver air filtered by Air Maze combination silencer oil bath filters into the air intake manifold. The exhausts of suitable pairs of cylinders are banked through an all welded water cooled exhaust manifold to four nozzles which direct and distribute the exhaust gas against the impulse blades of the charger turning a maximum of 12,500 rpm. The impeller of the charger is mounted on the same shaft. Speed of the charger varies with the load.

Capable of operation on either oil or gas or combinations of both, the engine is governed by a Woodward isochronous hydraulic governor which will automatically convert the engine to a full Diesel in the event of gas failure without causing it to drop any of its load. As a full Diesel, the conventional metered solid injection pumps located and enclosed directly in front of their respective cylinders force the fuel into the cylinders through differential type spray valves. As a combination engine or as a gas engine an additional 8-element American Bosch metered injection pump unit mounted outside the engine frame delivers pilot fuel for ignition to additional smaller differential type spray valves located near the intake valves which admit both intake air and gas fuel. An adjustment is provided so that the amount of pilot fuel can be regulated from 5 to 10% of full load requirements in order to obtain complete combustion of different grades of fuel gas. Governor linkage controls the flow of fuel gas into a chamber above a second disc on the intake valve stem which prevents the introduc-

tion of any gas from the fuel gas manifold under 20 lb. pressure into the air intake manifold during the period of the cycle that the intake valve is held shut.

During the 600 hours of operation, since installation in March, 1947 many tests have been made. The unit is capable of delivering 1300 kw. for short times with no evidence of pre-ignition. No variances in exhaust conditions have been observed, the exhaust being perfectly clear from no load to over load. The turbocharger operates at a higher speed when the unit is operating as a gas engine because of a slightly higher exhaust temperature which reaches a peak of 780 degrees. As the speed variation from no load to full load as a Diesel causes the charger to deliver additional intake air proportionate to the load as a function of temperature, so does the additional exhaust temperature resulting from the gas fuel as a gas engine cause the charger to run at a slightly higher speed, providing a slightly higher manifold pressure needed to insure sufficient oxygen necessary in a smaller space because of the volume of cylinder displaced by gas fuel. The engine therefore delivers full load and overload equally as well on either fuel or combinations of both.

Lubrication is of the full pressure type, the excess oil being used to cool the trunk piston heads which run in removable cylinder liners. Positive oiling to all internal working parts is by a large gear pump driven directly by the engine shaft and made accessible by its location outside the crankcase. Oil is continuously filtered through a Honan-Crane purifier which discharges directly into the bearing housing of the turbocharger. A Worthington auxiliary oil pump motor driven is standby.

Jacket water is made up from the condensate return system of the steam plant positively eliminating any possibility of scale within the engine. Chromate treatment is added to prevent corrosion usually resulting from the use of chemically pure water. Both the jacket water and cooling oil are passed through suitable Struthers-Wells shell and tube heat exchangers receiving their raw cooling water supply directly from the steam condenser circulating water discharge. Jacket water pumps are Worthington mono-bloc. One raw water pump is provided, this being a Worthington horizontal split case, double suction pump, experience showing the need of such a pump for this type of service.

Two 42 in. x 96 in. air receivers are automatically charged to 250 lb. psi. by a 7½ horsepower electric motor driven two stage Worthington air compressor which is equipped with a supplemental Continental air-cooled gasoline engine.

The engine is directly connected to a General Electric Company 1,080 kw., 1,360 kva., 3 phase, 60 cycle, 2400/4160 "Y" volts alternator. Excitation is by a General Electric ball bearing vee-belt driven exciter.

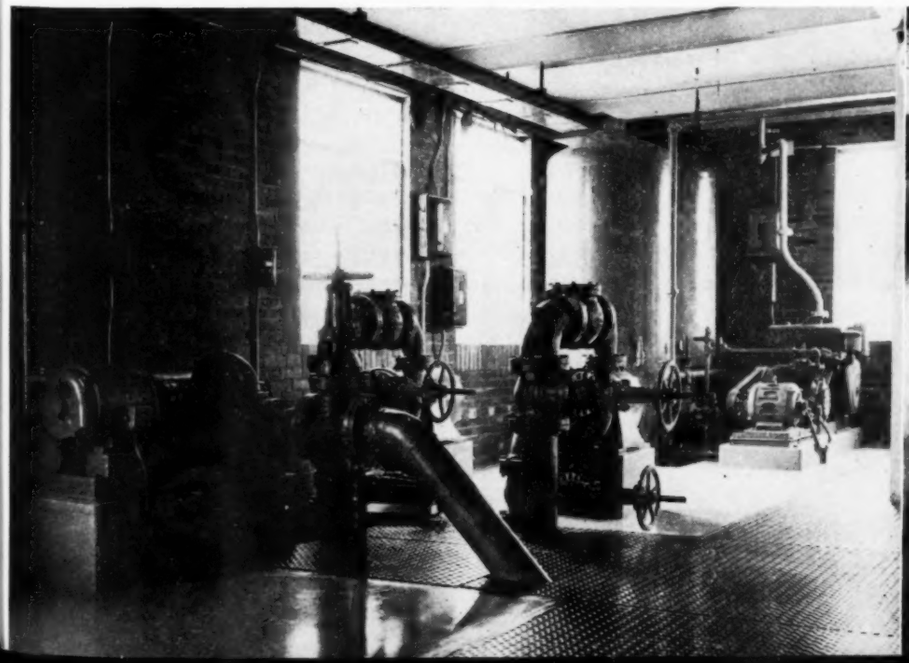
The selection of the dual fuel engine large enough to function as a peak load unit appears to have been excellent. With natural gas at a cost of 12½ cents per thousand cubic feet and a Btu. content over 900 per cubic foot, the fuel cost is about one half the fuel cost of the 400 lb. steam plant per net kwh. With a supply of cooling water above 5,000 gallons per minute and the ratio of cooling water to net kwh. needed in the steam plant about one to three in favor of the internal combustion engine, a great economy is available through the application of series use of cooling water. It is our belief that an auxiliary which is put to daily use will be much more readily available on a moment's notice than the usual engine that is installed as cheaply as possible, placed in some remote corner and too often forgotten. Instant availability of the Worthington dual fuel unit has shown us another advantage, this being that a kw. of engine capacity is equal to much more than a kw. of turbo-generator capacity when weighted in actual practice against the steam boiler-turbine combination either of which is inherently a part of the other, for, obviously a turbine cannot run without steam.

The anticipated peak load on the Lamar plant for 1947 is 5000 kw. For us the challenge is out to the engine builders for larger sizes.

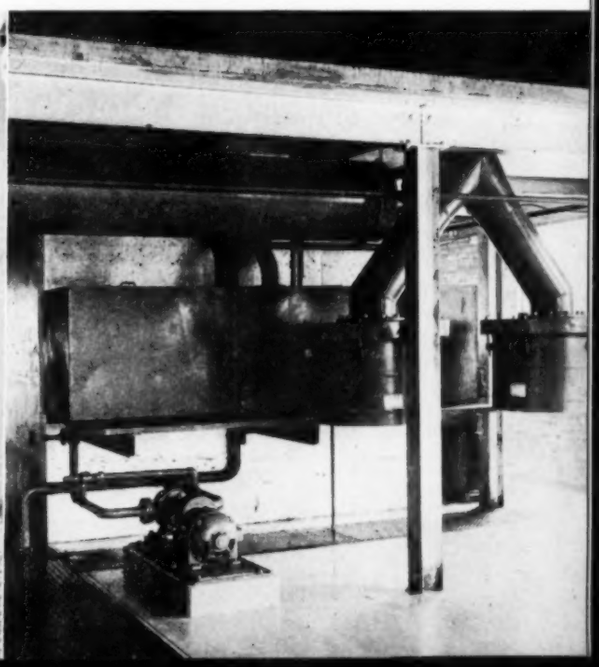
Lamar's electric department includes 85 miles of 22,000 volt transmission lines, distribution systems in Lamar, McClave, Willey, Bristol, Hartman, and West Farm, and rural lines to the Big Bend, May Valley and Wilson Junction. In addition to direct service to these areas, the plant sells electricity wholesale to the hay milling industry, the Lamar flour mill, the town of Granada, the Inland Utilities Company at Holly, and the Southeast Colorado Power Association. Because of this plant Arkansas Valley farmers pioneered in REA and the local plant now furnishes current to hundreds of farm homes.

The Lamar plant generates more electricity than municipal plants in many larger cities in Colorado. In 1944, for instance the total was 16,943,100 kilowatt hours, compared with 10,218,193 in the Fort Collins plant and 11,622,200 in La Junta. Last year Lamar made a net profit from the plant of $144,193.

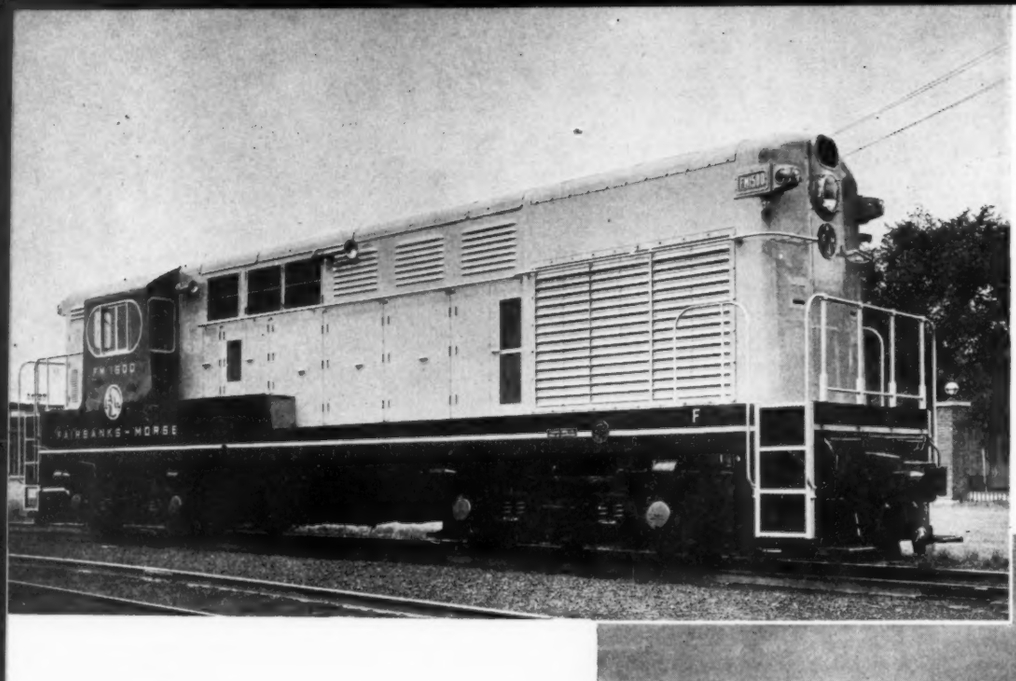
Jacket water pumps, raw water pump, and air starting equipment are located in the roomy ground floor of the new building which serves as the basement. Some temporary wiring is still seen for this improvement program has not been immune to delayed material shipments.



Suspended from the steel floor beams may be seen the fuel gas chamber. To its right are the Air Maze air intake filters.



NEW TY



(Left) 1500 hp., 114 ton multipurpose Diesel-electric locomotive built by Fairbanks-Morse and powered by 8 cylinder opposed-piston Diesel.

Heavy duty Diesel-electric locomotive built for freight transfer service by Fairbanks-Morse Co. develops tractive effort of 42,800 lbs. with a 2000 hp. F-M opposed piston Diesel.

THREE new-type Diesel-electric locomotives were introduced recently at the Railway Supply Manufacturers' Association exhibit at Atlantic City by the Fairbanks-Morse Co. Largest of these was the two-unit 4,000 hp. Diesel road locomotive, made up of two 2,000 hp. "A" units which have made history as part of the 8,000 hp. locomotive on the Kansas City Southern Lines. The other two Diesel locomotives shown were a 1500 hp. multi-purpose engine and a 2000 hp. heavy duty locomotive designed for freight transfer service. The latter locomotive is said to be the "most powerful Diesel locomotive ever built on 4 pairs of wheels." All of its 125 tons rests on the 4 driving axles. Its maximum continuous tractive effort is 42,800 lbs., while its maximum speed is 65 mph. The 1500 hp. multi-purpose locomotive was designed for lighter operation such as suburban passenger service, for general short-run passenger service, and for transfer and freight service. Complete with boiler, its entire weight aprpoximates 114 tons. This brings the locomotive with the axle loading limits of lines using light rails. Where heavier rails are used, the new locomotive can be made heavier, to increase tractive effort.

All three of these locomotives are powered by the Fairbanks-Morse opposed piston type Diesel. The 4000 hp. road locomotive having two 10-cylinder Diesels, the heavy duty freight transfer locomotive—one 10-cylinder and the multi-purpose locomotive—one 8-cylinder Diesel. Both type engines have a bore of 8⅛ inches and a stroke of 10 inches per piston. They operate on the two-stroke cycle. The engines have no valves and make use of the upper and lower piston in each cylinder to cover and uncover the inlet and exhaust ports respectively.

The main frame or cylinder block is of welded steel construction. Two trunk type semi-steel pistons operate in each cylinder. They are cooled by circulating lubricating oil through them. They are equipped with cast iron rings and a separate insert carries the piston pin.

Each cylinder is provided with removable liner made of cast iron and has a pressed on steel water jacket. The liner contains the intake and exhaust ports. Liners and water jackets are replaced as one unit. All water and fuel oil connections are outside, thereby eliminating the possibility of crankcase contamination.

Both crankshafts are made from chrome nickel molybdenum alloy, with all bearing surfaces highly polished. Removable bearings of the precision type are located between each cylinder and at each end. The fuel injection system consists of two injection pumps and two nozzles for each cylinder. An engine driven fuel oil supply pump takes the oil from the fuel tank and forces it through a filter into the header of the engine. The positive displacement blower of rotating type provides the air for scavenging and charging the cylinders. The blower is located directly above the main traction generator and is driven from the upper crankshaft by means of helical gears.

Positive displacement gear pump supplies a continuous flow of filtered oil to all bearings and for cooling of the pistons. The oil is cooled by circulation through a water cooled heat exchanger.

Water for cooling the engine and lubricating oil is supplied by engine driven centrifugal pumps, one for circulating the water through the engine and radiators and the other for circulating water through the lubricating oil heat exchanger and its radiator. Correct engine temperature is maintained at all times by thermostatically controlled radiator shutter, and the speed of motor driven fan. An emergency manual shutter control is also provided.

EW TYPE DIESEL LOCOMOTIVES

The engineer's throttle controls the engine speed through the governor. A hydraulic type governor and autoload control provide for complete control of the engine and generator output. This regulating system holds desired engine speed and controls loading of the power plant through the exciter. A separate overspeed governor is provided. All engine controls necessary when locomotive is in use are located on the control panel in the cab of the locomotive. This includes all temperature and pressure gauges.

Cranking of the engine is accomplished by motoring the main generator through use of starting winding energized by the storage battery. An overspeed governor, manual shut down, and a low lubricating oil pressure shut down are included in the engine as protective devices. These are reset manually.

A Westinghouse self ventilated main generator is directly connected to the engine crankshaft through a flexible coupling.

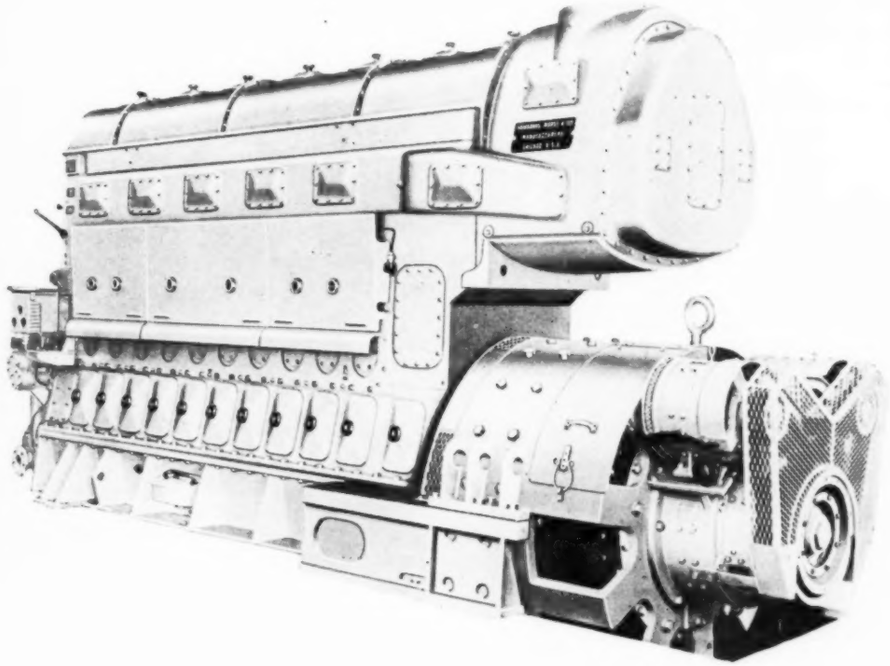
The commutator end is supported by a roller type anti-friction bearing. The generator is separately excited from an exciter mounted on the main generator and driven by Vee-belts from a shaft extension of the generator.

The four Westinghouse series wound, force ventilated, traction motors are mounted on the driving axles. The motor armature is supported by anti-friction type bearings and single reduction gearing is provided for driving purposes. One auxiliary generator mounted on the main generator and belt driven from shaft extension of main generator provides power for battery charging, controls and lighting. One fan generator mounted on the same shaft as the main generator provides power for the radiator fan motor and two traction motor blowers. Two blowers for cooling the traction motors are provided. Both blowers are driven by electric motors, the blower runner being mounted on the motor shaft.

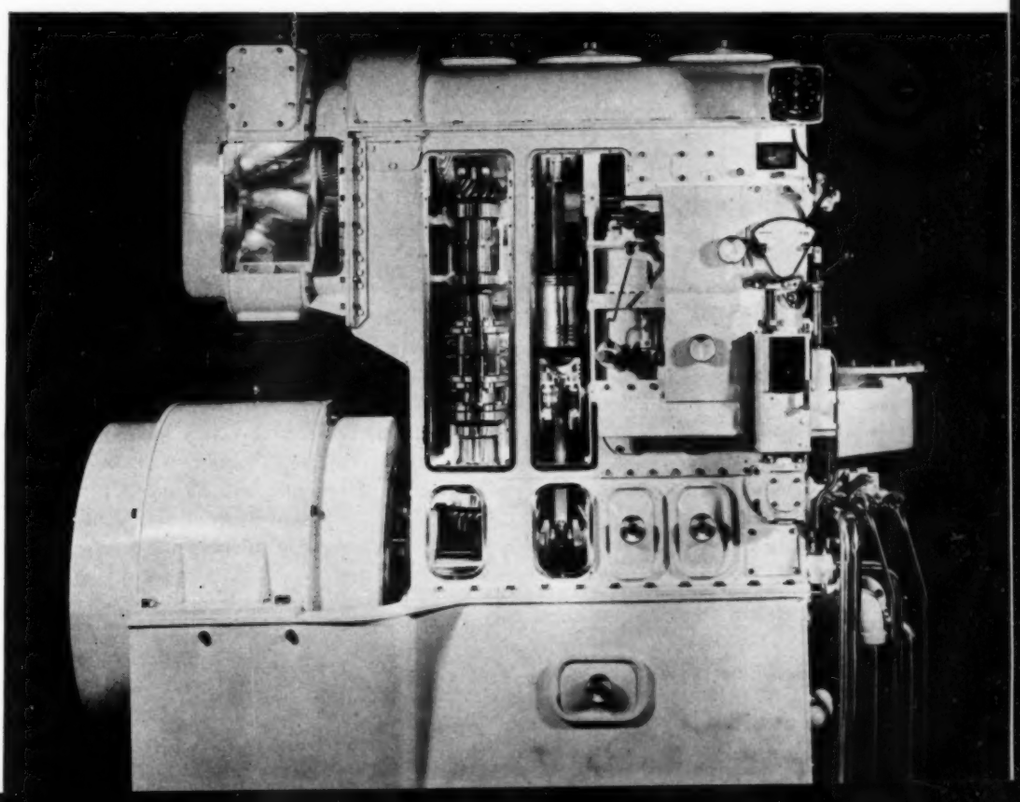
All the control equipment for the main and auxiliary circuits is located in an equipment cabinet in the cab which is fully accessible for inspection and maintenance.

Electro-pneumatic control permits forward and reverse operation with permanent series-parallel motor connections, with two step automatic shunting of traction motor fields.

All power control circuits are electro-pneumatic in operation. Manual throttle operation controls both engine speed and reversing with one lever.



Fairbanks-Morse opposed-piston Diesel engine 2000 hp., 10 cylinders, 8⅛ x 10 inches.

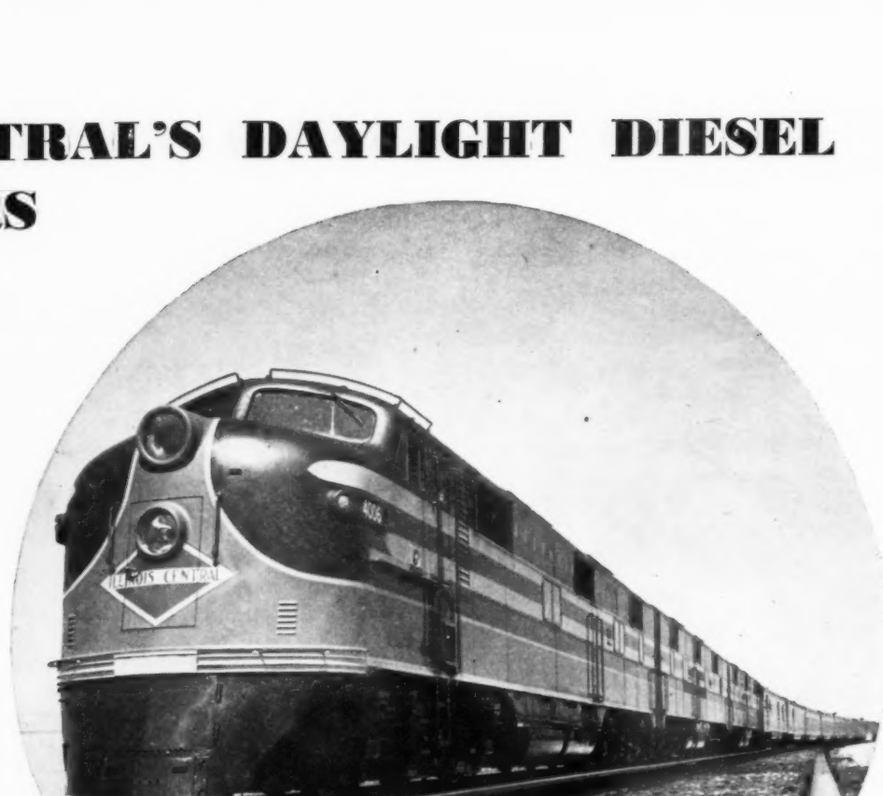


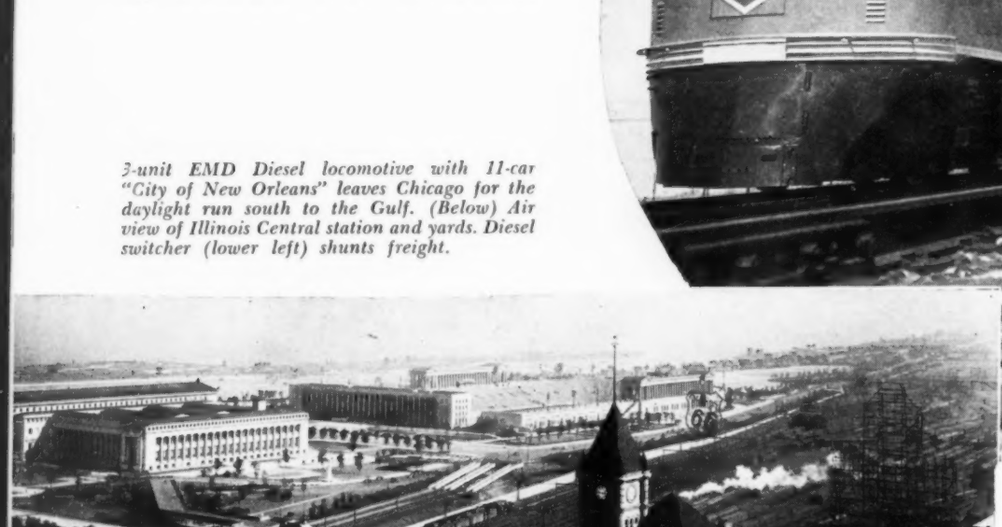
Cutaway model of opposed piston Diesel exhibited at recent railroad convention at Atlantic City.

ILLINOIS CENTRAL'S DAYLIGHT DIESEL STREAMLINERS

New Diesel Trains Make Chicago New Orleans Run In 15 Hours, 55 Minutes

By CHARLES F. A. MANN





3-unit EMD Diesel locomotive with 11-car "City of New Orleans" leaves Chicago for the daylight run south to the Gulf. (Below) Air view of Illinois Central station and yards. Diesel switcher (lower left) shunts freight.

WHAT can be happily labelled as America's first truly "postwar" luxury dayliner coach train was launched in the late Spring to provide a type of high-speed, ultra luxurious daily service between Chicago and New Orleans, by the doughty Illinois Central Railroad. No expense or research detail was spared to evolve a pair of 14-car Diesel trains out of the skill and experience that U. S. builders and suppliers have developed since the dawn of the Streamliner era 12 years ago. Practically every tried and tested invention ever built for a modern railway operation has been incorporated into these trains, which together with Great Northern's new Empire Builders and B & O's Cincinnatians (steam powered temporarily), compose the nucleus of some 50 or 60 magnificent Diesel train-sets that will race over the land between midsummer 1947 and the Fall of 1949.

Motive power for the twin "City of New Orleans" consists of a pair of 3-unit, 6000 hp. EMD high speed passenger Diesel locomotives, embodying added water storage capacity and all the little roominess features in their new cabs and engine room layouts. Illinois Central, with its Diesel "Green Diamond" train was one of the early pioneers of Diesel passenger equipment. Last U. S. pre-war luxury train was the twin Pan American Limited, for the Chicago-New Orleans luxury night run, so it follows that the first postwar U. S. long-run day trains are fittingly Illinois Central products, brought up to date from the war years' experience with the Pan Americans, and their 4,000 hp. two-unit EMD Diesel locomotives.

The run between the Great Lakes and the Gulf is 921 miles, a bit short of being the same distance between Chicago and New York. Far-sighted railroaders, after seeing what Diesel will do on fast, 1,000 mile runs, have long had their eye on the Chicago-New Orleans route as

well as the Chicago-New York-Boston route for a new kind of high-speed luxury train. If people rode the night Diesel coach streamliners, why wouldn't a daytime version on faster time, prove even more popular? So, Illinois Central beat the U. S. lines to the draw—even the Burlington and UP, on the 1,000 mile Chicago-Denver route and the Eastern trunklines on the Chicago-New York route, by many months.

Diesel has not only made 450 mile afternoon speed runs a possibility, but has initiated 1,000 mile dawn-dusk runs, opening up a whole new block of track miles for those railroads who do not choose to howl about a "recession," but see a pent-up public bursting to go places in swift, clean style behind Diesels, at 2 cents a mile. Further, five U. S. railroads are following the Illinois Central's lead and are slyly hauling mail, baggage and express on the head ends of these new postwar daytime flyers—not for the fun of it, but for revenue that was evaporating to buses and airlines. The morning local theory of baggage-mail-express haulage is abruptly giving way to Diesel streamliner haulage, much to the joy of the postal service and to railroads wedded to vanishing day head-end business. Now you ask, "Why the above detailed case for rejuvenation of the old mornnig local? Well, in a journal like DIESEL PROGRESS, we are concerned now with sound economic application of Diesel. Diesel railroading is sweetly profitable, now the job is to extend it in every direction. There have been put into service perhaps 75 of the so-called "morning local" type Diesel trains—sprightly new trains of from 4 to 8 cars, drawn by 2,000 and 4,000 hp. locomotives. Some have as many as 12 cars.

The Illinois Central with their twin "City of New Orleans" dayliners, have gone boldly ahead with one or two steps farther out in the direction of Diesel railroad progress. First, they have put the heaviest type of mountain Diesel power on their flat-country day train—6,000 horsepower, exactly the power that hauls the City of San Francisco streamliners over the Rockies or the Santa Fe's fast mail. In flat country mind you. First, to provide a complete system-wide change in operating practice, wipe out the morning local idea, and give high speed terminal to terminal operation, yet serve valuable freight-originating intermediate territory, all with one train!

The new Illinois Central dayliners make 19 intermediate stops on this 921 mile run—the New York Central would freeze solid if the Century made 19 stops for passengers—yet they do it all in 15 hours and 55 minutes. Because they have six thousand horsepower to get a 14 car train up to 95 mph. in four minutes flat. Not only this, but 10 minute stops are arranged to cut in one coach from St. Louis at Carbondale, Ill., and another ten minutes at Fulton, Kentucky, to cut in two more coaches from Louisville. Chicago on the Lakes; St. Louis in the heart of the Midwest and Louisville, way up in Kentucky, all funnel together and arrive in New Orleans as one 14-car train, 7 days a week. Northbound the process is reversed, giving service from the Gulf to these 3 key terminal cities. The IC people, with but two 14-car Diesel streamliners, and two Diesel side-main connections, render a unique passenger service not found any place else in the U.S.A. That is why this $3,000,000 investment in new equipment is expected to arrive at some magnificent statistics when the year-end accounting is made to shareholders and the public.

Deluxe Observation, Tavern, Lounge car of new "City of New Orleans" dayliner.

Briefly, the equipment of the twin trains consists of 14 luxury daycoaches designed and built by the Pullman Standard Car Co. at Chicago, 7 for each train, and two each of mail-express; baggage-dormitory; restaurant-lounge-diner; full diner and observation-tavern-lounge cars, all built from rugged skeletons of once fancy, heavy special cars on pre-war IC passenger runs. (Parlor, diner, express-mail and other solid cars, but outmoded as to equipment and furnishings). These special cars were all built at the company's Burnside (Chicago) shops, and are quite the finest turned out so far this year. Four of the Pullman coaches are the day-night coaches with fancy leg rests and seat 48. The rest are 56 seat luxury coaches with smaller powder rooms. All cars on the train are air conditioned by Waukesha engines and Frigidaire air conditioners. The dormitory section for the very large crew contains a novel idea in day trains. This space is a regular crew's lounge, with soft seats, washrooms and smoking facilities. And fully air conditioned, too. The car has a 25 ft. baggage section, 6 ft. linen room; 29½ ft. dormitory for 20 men; 6½ ft. steward's room with wash and toilet room and 7 ft. conductor's room.

With this car, second from the locomotive—mail and express car ahead, the front end of the trains at once becomes headquarters for the large operating crew—nearly 30 people in all—necessary to handle the 488 passenger seating capacity on the long, swift run. Besides the diner, a regular luxury type dining car, there is a lounge-restaurant-lunch counter car, with its own kitchen, and a stewardess' headquarters room. Providing for the comfort and efficiency of the crew is one of the salient features of the trains, that may soon set the pattern for all other railroad operation. It is pleasing to note the great forward steps in this touchy business of taking care of the manpower that the I.C. has done with this carefully planned design.

With ample reserve power, the Diesels can maintain a uniform high speed, with no excessive speeds; run the whole 921 miles without more than two brief stops for fuel and boiler water (in Winter). Servicing the Diesels will be done in the terminal cities, and it is expected that these two locomotives will maintain double daily service 95% of the days of the year without going into the shops and skipping a run. Nearly 2 solid hours are used up in making the 19 stops, for time lost in stations and time decelerating and accelerating. To average nearly 60 mph. over the whole run, it means *averaging* better than 70 mph., which means the trains have to do 90 or 100 mph. frequently to keep on time.

NEW DIESEL COMMUTER SWITCHER

New 1500 Baldwin commuter-switcher works freight in Jersey City yards.

THE day when the engine took the early-morning train up the line and lay around idly all day waiting for the late afternoon passenger run is over, so far as *Baldwin's* new type Diesel locomotive is concerned. In the morning the new 1500 hp. Diesel hauls her commuting passengers to work. Then she trots out into the yards for a day's work of freight hauling. On occasion, when an extra long train needs a push "over the hump" she becomes a pusher, never complaining at whatever lowly task she is given.

Typical of the road tests being given the new locomotive all over the country is the series of tests given her on the lines of the Central Railroad of New Jersey recently. Operating out of Jersey City, she was taken up the line in one direction and placed on a passenger run. Then she was shifted to freight service and to transfer work, then to a different type of switching, and finally back to passenger service on various parts of the railroad system, which spreads out through a considerable part of New Jersey. Sometimes she worked day and night.

The Baldwin combination road engine and switcher has certain definite advantages in its multiple uses on a railroad. For one thing, there is provision in the design for a train heating boiler, which would not be necessary with the ordinary switcher. For another, the average road locomotive which travels efficiently at higher speeds cannot do so well on the slow speeds required for switching and transfer work. And for a third, the new engine has a swing bolster truck, a feature which permits the engine to ride with extreme smoothness even at speeds in excess of 35 miles per hour.

At head end of commuter train, versatile Diesel locomotive makes late afternoon run.

GENERAL CHARACTERISTICS

Specifications DR-4-4-15-6			**Type: 0-4-4-0**
Gauge			4' 8½"
Diesel Engine	One 8 Cylinder		Supercharged
	HP, for traction		1500
Supercharger			Turbo Type
Driving Motors	Number		4
	Type		370
Journal Bearing	Size		6½" x 12"
Wheels	(Idling) Driving		2 Pairs
	Diameter		42 Inches
Wheel Base	Each Driving Truck		11 Ft. 6 In.
	Total Locomotive		43 Ft. 9 In.
Running Gear	Swivel Trucks		Swing Bolster
Underframe Construction			Cast Steel
Total Weight	In Working Order		280,000 Lbs.
	On Drivers		187,000 Lbs.
	Light		260,000 Lbs.
Maximum Overall Dimensions	Width		10 Ft. 2 In.
	Height		14 Ft. 0 In.
	Length (Inside Knuckles)		58 Ft. 0 In.
Minimum Radius Curvature	Locomotive with Train		249 Ft. (23°)
Supplies (Total Capacity)	Lubrication Oil		135 Gal.
	Fuel Oil		1000 Gal.
	Engine Cooling Water		290 Gal.
	Sand		30 Cu. Ft.
	Heating Boiler Water		800 Gal.
Performance Options			
Gear Ratio	15:63	19:60	21:58
Continuous Rating T. E.	42,800	32,200	28,100 Lbs.
Continuous Rating Speed	10.5	14	16 MPH
Maximum Safe Speed	65	82	93.5 MPH
Starting Tractive Effort (At 30% Adhesion)			56,000 Lbs.

A. A. R. CONVENTION—ATLANTIC CITY

DIESELS were predominant at the Convention of the American Association of Railroads and the Railway Supply Manufacturers Association held recently at Atlantic City, New Jersey. As a matter of fact, out of ten locomotives on exhibit, nine were Diesels. They represented the latest designs of the American Locomotive Company, The Baldwin Locomotive Works, the Electro-Motive Division of General Motors, and Fairbanks-Morse and Company. This predominance of Diesels at the convention reflected the great change that has come in railroad motive power in the last six years. Comparisons between the first quarters of the years 1941 and 1947 show an amazing increase in Diesel motive power. In this interval figures show that Diesel-hauled gross freight tonnage increased from .08% to 10.98% of the total, while in passenger traffic, the use of Diesels increased from 7.11% to 22.15%. Furthermore it is a certainty that the percentage of railroad traffic hauled by Diesels will increase steadily. Most locomotive builders are concentrating on Diesel production entirely.

A considerable portion of the Convention's business centered around Diesel and the procedural changes it has entailed in railroading. Perhaps one of the most interesting discussions at the convention was the report by J. P. Morris, General Mechanical Superintendent of the Santa Fe Railroad. Representing a railroad that has over 700,000 hp. in Diesel motive power, the largest roster yet obtained by a U. S. railroad, Morris spoke with authority. At present the Santa Fe is operating three transcontinental trains consisting of 18 sets of Diesel equipment. When Santa Fe's order for 78,000 hp. in new Diesel equipment comes through, it will have 26 Diesel-electric locomotives of 6,000 hp. handling four complete streamlined transcontinental trains and one transcontinental mail train. Four new Diesel-electrics will handle the new Texas Chief. Santa Fe also operates two streamlined Diesel trains between Chicago and Oklahoma City, two between Los Angeles and Oakland, California and several others on shorter runs. For freight service Santa Fe has fifty-three 5,400 hp. freight locomotives.

The Santa Fe maintenance shops are located at Barstow, California and Cleburne, Texas. A new Diesel shop is being built at Barstow which will take care of the new Diesels now on order. Morris' report indicated that there had been a considerable drop in Diesel repairs under the five year average of 1941-1945. He attributed this to the research and development by the engine manufacturers. Summarizing maintenance requirements for Diesel motive power Morris listed the following factors that should be considered. 1—supervision and instruction of personnel; 2—maintenance facilities; 3—maintenance schedules; 4—quality of fuel, lubricants and water available; 5—cost of repair parts; 6—design of locomotives; 7—water treatment; 8—load factor. Proper supervision and instruction of personnel is a potent factor in reducing maintenance costs according to Morris. Centrally located repair points and progressive maintenance practices come close behind. On the subject of standardized parts Morris stated that it would be of great advantage if builders would standardize on an interchangeable truck which would be suitable for all types of Diesel locomotives. Morris listed 17 possible improvements in the design of Diesel locomotives. Among these were the need for standardizing parts for interchangeability, application of more adequate lubricating oil filtering systems, application of automatic protection devices to protect engines from high water temperatures and low oil pressures, and the use of chromium plated cylinder liners.

Turning again to the bright side of the Diesel picture, Morris compared steam and Diesel freight operation over a period of one year on similar railroads, one steam, the other Diesel. The total cost of repairs, depreciation, fuel, water, lubrication, supplies and engine house expenses amounted to approximately $13,500,000 for steam and $8,750,000 for Diesel. As regards dynamic braking Morris reported that prior to the use of Diesels so equipped, 2,000 to 2,500 wheels had to be removed every month because of burned brakes. Now only 400 wheels are being removed monthly.

The committee report on fuel brought out some interesting facts. As against 1945, coal purchases in 1946 declined 13%. Fuel oil purchases stayed about the same, while purchases of Diesel fuel increased 24% over 1945 and were almost double the figures of 1944. This report of increased Diesel fuel consumption was backed up by the Locomotive Construction Report by H. H. Lanning which stated that there was an increase of 26% in the number of Diesel locomotives in service during 1946 when 760 new locomotives were added. The largest percentage of gain was made in the freight and switch classes which included the combination passenger-switch type Diesels.

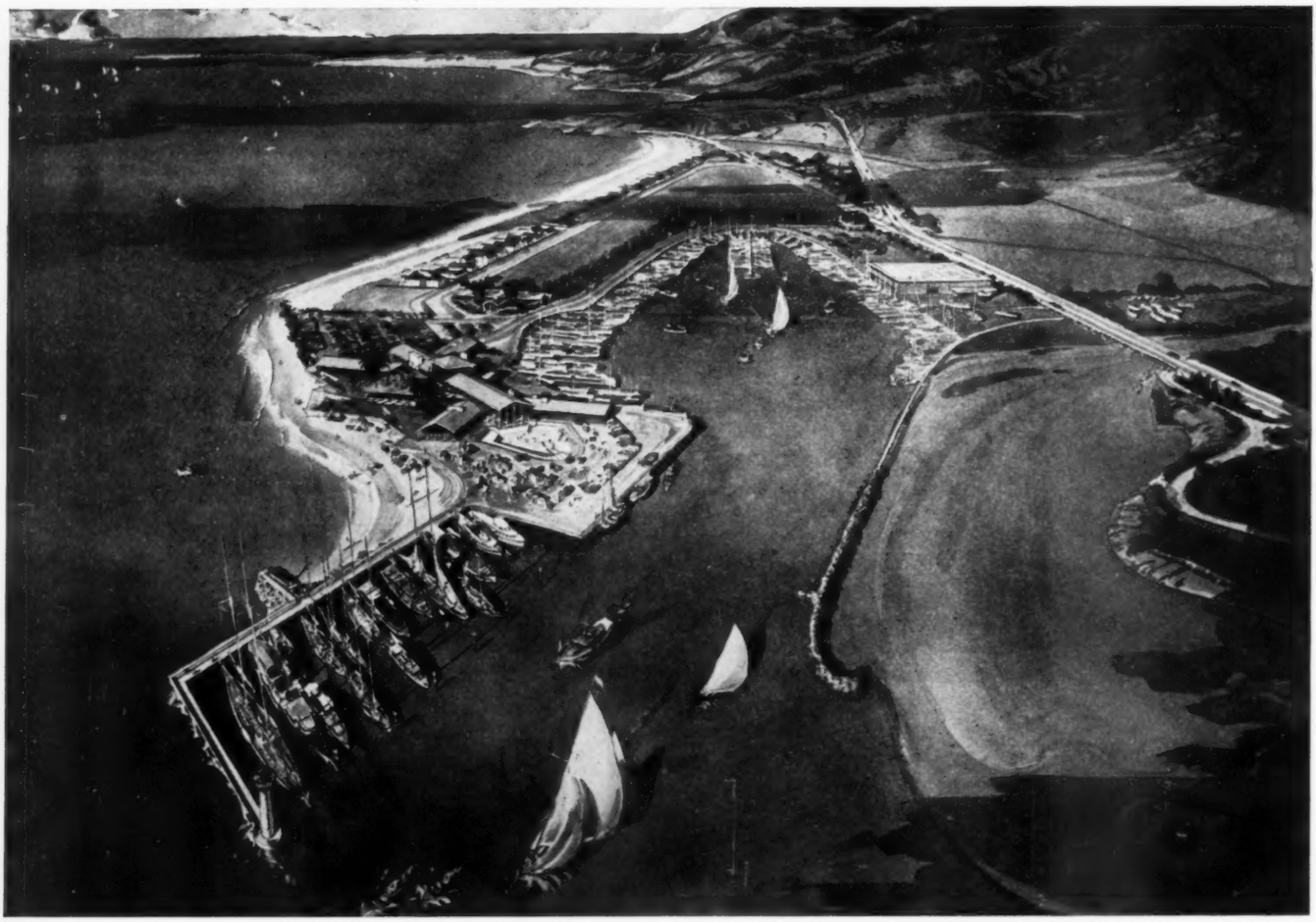
As regards fire protection for Diesel locomotives, the committee recommended the following: For road Diesel locomotives—not less than 100 lbs. carbon dioxide with means of distributing in engine room. Not less than 1 quart of carbon-tetrachloride in cab. For outside it was recommended that 200 gallons of water be available to be propelled by carbon dioxide in form of foam through 1½ inch hose or the use of fog type nozzle with water alone.

The Railway Supply Manufacturers Association exhibit is one of the most impressive of all industrial shows. Among some 250 exhibitors many of the following concerns featured Diesels and allied equipment:

Aluminum Company of America, American Bearing Corporation, American Locomotive Company, The Baldwin Locomotive Works, Bowser, Inc., The Buda Company, The Budd Company, Caterpillar Tractor Company, Chicago Pneumatic Tool Company, C-O-Two Fire Equipment Company, Crane Company, Dearborn Chemical Company, Detroit Lubricator Company, Double Seal Ring Company, Eaton Manufacturing Company, Elastic Stop Nut Corporation of America, The Electric Storage Battery Company, Electro-Motive Division, Evans Products Company, Ex-Cell-O Corporation, Fairbanks, Morse & Company, Farr Company, Fulton Sylphon Company, General Electric Company, General Machinery Corporation, Giddings & Lewis Machine Tool Company, Gould Storage Battery Corporation, Hallett Manufacturing Company, Hyatt Bearings Division, Ingersoll-Rand Company, International Nickel Company, Inc., Walter Kidde & Company, Inc., Koppers Company, Inc., M and J Diesel Locomotive Filter Corporation, Menasco Manufacturing Company, Minneapolis-Honeywell Regulator Company, Nathan Manufacturing Company, National Bearing Division, Oakite Products, Inc., Paxton-Mitchell Company, H. K. Porter Company, Inc., The Ready-Power Company, Reynolds Metals Company, Scintilla Magneto Division, R. H. Sheppard Company, S.K.F. Industries, Incorporated, Sperry Products, Incorporated, The Texas Company, Timken Roller Bearing Company, Van der Horst Corporation of America, Vapor Car Heating Company, Inc., Walworth Company, Waukesha Motor Co., Westinghouse Air Brake Co.

DIESELS HELP BUILD LUXURY YACHT CLUB

By FRED M. BURT



Artist's sketch of Malibu Quarterdeck club as it will appear when completed. Harbor and ground improvements totalling over a million dollars are now underway with Diesels doing a large part of the work.

WHEN the very specific and complete plans for the new Malibu Quarterdeck Club are translated into a living actuality, Southern California will add another touch of glamour to her already sparkling reputation. The new club will be a combination vacation spot and yacht club catering to swimming and sailing enthusiasts of the movie colony.

Close by, running off to the north along Malibu Beach, are the swank "cottages" of well-to-do Angelenos, including many in the amusement field—moving pictures, stage and radio.

On the other side of the club properties is the State Highway Route 60, the Roosevelt Highway, the main coastal route north to Ventura, Santa Barbara and on to San Francisco. At this point, where the highway narrows, a five mile stretch is being relocated and reconstructed to provide a four-lane divided highway. Peter Hiewit Sons' Co. is the contractor on this 1½ million dollar project, using all-Dieselized equipment, to be further described.

Edward D. Turner, president of the Malibu Quarterdeck Improvement Company, the holding company that purchased the 47-acre property and will handle the construction of the whole project, selected the site. He made careful surveys up and down the coast, within reasonable driving distance of Los Angeles. The only fully suitable site found was this, the ideal site. In addition to being adjacent to the Malibu colony, the club is only a 15 to 35 minute drive from Santa Monica, Beverly Hills and Hollywood, where live many of California's motor boating and yachting enthusiasts.

"Commodore" Turner, a successful business

man, after service abroad in World War I, then in the amusement field as an enterpreneur and turning "lemon" moving picture theaters into prosperous units, and other successful ventures, financed and built the Miami Quarterdeck Club, coming from the east two years ago to find outlet for his energies.

Plans for the harbor improvement were developed by Taggart Aston, Consulting Engineer of Los Angeles. They involve construction of a 4700 ft. sea wall and bulkhead to protect the grounds, buildings and harbor. About 600,000 cu. yds. of material will be dredged to provide a protected yacht harbor with a depth of 12 ft. below lower mean tide.

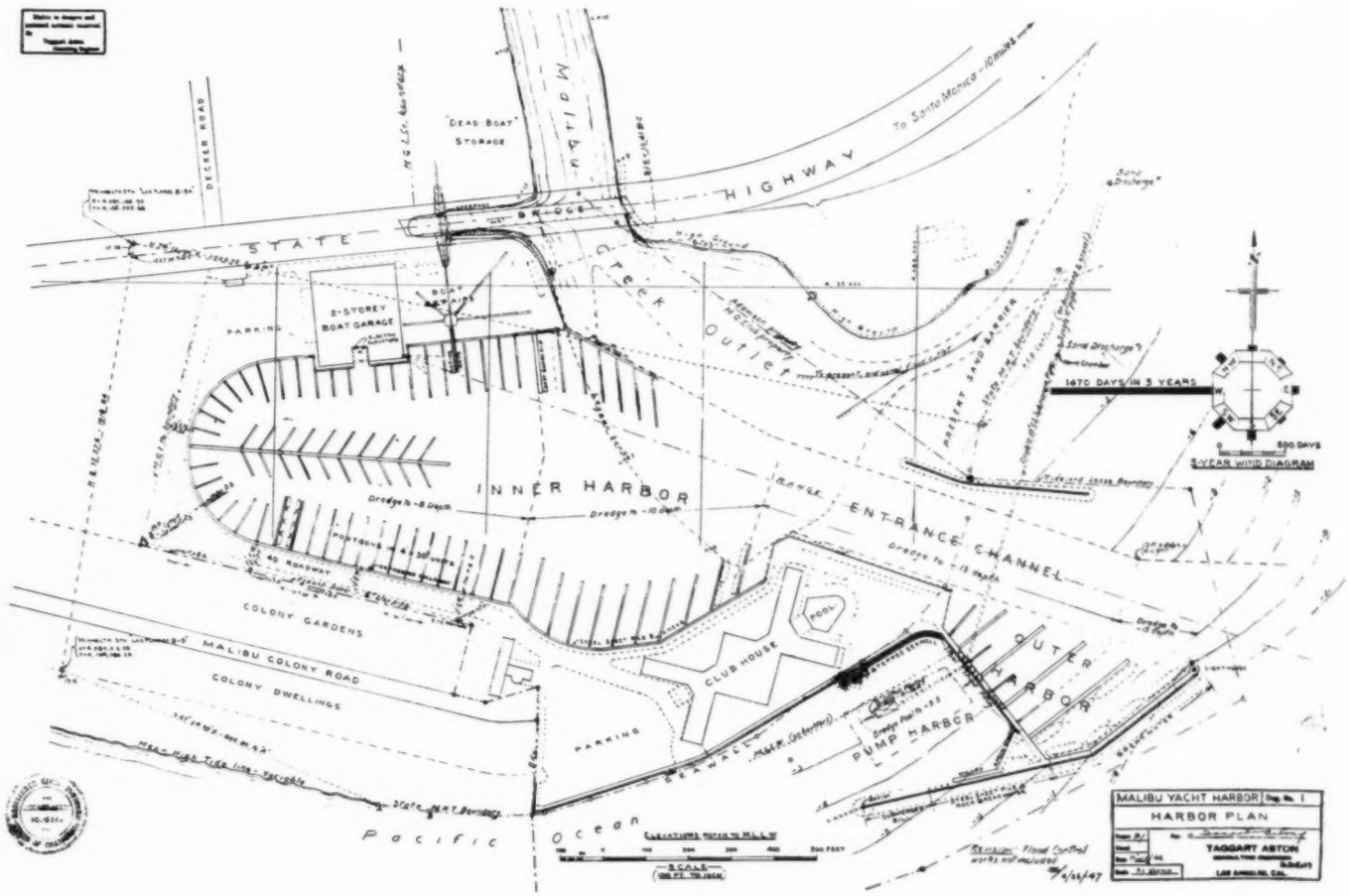
Equipment to be used is a Kinmont, 20 ft. x 50 ft. steel-hulled, sand-sucker dredge. It will have a 2800 gpm. centrifugal, dredging pump, connected to a 12 in. suction pipe and with a 10 in. discharge pipe mounted on floating pontoons. The 200 hp. pump motor will be fed by submarine cables running from shore power lines to a cable reel on the rear of the dredge, also the location of the voltage-reducing transformer. Around the suction head, an 8 nozzle jet will be supplied with water at about 250 lb. pressure from a 50 hp. jet pump, to loosen the material to be dredged.

Forward, a 20 hp. "Caterpillar" Diesel-generator set will supply power for dredge movement. Constantly running, this variable speed DC unit will operate three drums forward, with controls running from the lever room above to the clutches on each drum. The port and starboard drums will carry cable swing lines attached to anchors, some distance forward and to each side. Also on the forward cross-shaft, which is geared to the motor, is another drum in the center, used to raise and lower the suction pipe. A short distance aft the rear cross-shaft operates two drums to handle the 10 in. diameter, pointed steel spuds used to anchor the dredge in the rear. This set-up allows the dredge to be swung 45 degrees to each side, or a total of 90 degrees movement, so that the dredge can be "walked" with ease to all points.

This dredge will be permanently located in the shelter of the breakwater. Sand drift will be pumped through two pipe lines laid under the harbor entrance, with the three discharge points further down the beach. The natural drift will continue its movement down the shore line.

The 92 ft. x 100 ft. swimming pool will be emptied and filled with the 75% fresh water and 25% sea water, recommended as best suited for swimming, by pumps powered with a Diesel engine. 3,000 ft. of graded roadway will provide access to all parts of the grounds. There will be parking space on the property for 750 autos. A 200 ft. x 220 ft. two-story concrete boat garage will provide storage facilities for 180 boats in the 28 to 30 ft. class. It will have two, submersible, electrically-operated elevators, and cradles, for individual parking of boats, thus providing a fast "in and out" service.

In the large, two-acre boat repair yard next



Harbor plan for Quarterdeck Club showing proposed water depths as well as boat storage and mooring areas. Highway, north of harbor, is being widened and improved.

Artist's sketch of Cocktail Lounge of the Malibu Quarterdeck Club looking across the inner harbor to the boathouse.

to the "garage," craft up to 200 ft. can be handled on the marine railways. In one corner, next to the rear end of the garage, a Gray-marine, 225 hp. Diesel engine and cable drum combination will be used to pull boats out of the water on cradles, and thence out on any of the four diverging tracks, or straight ahead to the underpass leading to the "Dead Boat" storage. This movement will be effected by passing the cable around pulleys at the ends of the tracks to be used, and then pulling to position at 60 ft. per minute, after the boats are spotted on the turntable through use of its pulley.

Preliminary engineering work for the ground and harbor improvements is progressing under the supervision of the Johnson Western Company of San Pedro, engineering contractors. Their contract is estimated to involve about $1,200,000, or approximately 50% of the total cost of the project.

Designer Cliff May of Santa Monica developed plans for the buildings. The first one to be built, (construction to be started in the summer of 1947, with other work to proceed as fast as circumstance will allow), will be the Malibu Quarterdeck Club Service club building, to supply accommodations for executive personnel. This building will be used temporarily, however, as a first club house for members until the main unit is constructed.

Cliff May has made use of the low, rambling rancho style, adapting it with skill to the needs of a large modern club. Included is a generous use of tropical plantings. The central "backbone" structure will house, over the lobby and two foyers, thirty guest suits. In the central tower, on the third floor, are four de luxe apartments, and above these is the "crow's nest," a large, glassed-in room for watching regattas.

Four, single-story, projecting wings are devoted to functions of service, management, lounging, and bathing.

At work on the state highway north of the new club, Caterpillar tractors haul LeTourneau Carry-all scrapers and sheepsfoot roller. Sterling water truck (foreground) is Cummins Diesel engined. This project, five miles of four lane highway, is under the direction of Peter Hiewit Sons' Co.

The nearby highway project previously mentioned, relocates the highway, for the nearly five mile long stretch, at a higher level, a little distance inland from the old and narrow coastal route, which was afflicted from time to time, with unpreventable land slides. The assembly of all of the equipment used by Peter Hiewit Sons' Company on this job would look like a Diesel equipment show. Three No. 6 Northwest shovels used in making cuts on the tops of the banks and in roadbed cutting have Murphy Diesel engines (2) and a Model D-8, "Caterpillar." For hauling dirt away, four rear dump, 15 yd. Euclid trucks are powered with Cummins 150 hp. Diesel engines, and 10 bottom dump, 18 yd. Euclid trailers are pulled by Euclid tractors with the same Cummins engines. Five Tournapulls with LP scrapers are powered with supercharged Cummins Diesels.

Determining Specific Performance In Terms Of BTU

By GLENN C. BOYER*

Mr. Boyer's argument could easily start a controversy and perhaps lead to a revolution—bloodless, that is. Such things, however, bring about either progress or continuation of the old order with the dissenters in either case, strewn along the way—still alive and kicking of course. So long as heating values of fuels vary all over the map why not get rid of "Reference Fuel" and determine engine performance directly on the basis of heat units consumed per brake-horsepower-hour?—The Editor.

SPECIFIC fuel-consumption performance of Diesel engines has been reported as pounds of fuel per brake horsepower hour output for so long that everyone dealing with Diesel engines naturally thinks of performance on that basis. Determining specific fuel consumption by weight would be ideal if all fuels had the same heating value per pound. Fuels, unfortunately, vary widely in their heating values, and in order to compare the performance of engines burning different fuels, it has been necessary to convert the weight of fuel of known heating value actually burned to a hypothetical weight of fuel having a standard heating value.

For example, if an engine is guaranteed to produce a bhp.-hr. burning 0.38 lb. of fuel with a heating value of 19,000 Btu. per lb., and on actual test consumes 0.36 lb. of fuel having a heating value of 19,400 Btu. per lb., it is necessary to convert the actual test data to the guarantee basis in order to ascertain if the engine performs as well or better than the manufacturer claims. In this instance, the engine theoretically consumes 0.365 lb. of fuel oil having a heating value of 19,000 Btu. per lb.

How is this conversion from actual to reference fuel determined? The simplest approach to that question is to consider the quantity of heat energy, measured in Btu., supplied to the engine per unit of power produced. The guarantee states that 0.38 lb. of oil having a heating value of 19,000 Btu. per lb. would be burned per bhp.-hr. developed. This amounts to 0.38 x 19,000 or 7,200 Btu. During test the engine consumed 0.36 lb. of oil with a heating value of 19,400 But. per lb., a heat input of 0.36 × 19,000 or 6,984 Btu. The weight of reference fuel (heating value 19,000 Btu. per lb.) that would have been burned is 6,984/19,000 or 0.365 lb.

In the final analysis, all fuel-consumption measurements are based upon the heating value of the fuel. Somewhere in the process of making fuel-consumption tests of engines, it becomes necessary to deal with the Btu., the fundamental unit of heat measurement in American engineering practice. Since this is the case, why not express specific fuel-consumption performance of all engines in terms of Btu's rather than in terms of pounds of fuel? Certainly it would be a change from currently accepted practice where everyone now thinks in terms of pounds of fuel per unit of output. But is the suggestion so radical?

Within the past several months, the Diesel Engine Manufacturer's Association has changed the heating value base for reference fuel from 19,000 to 19,350 Btu. per lb. of fuel, the present international standard. The internal-combustion engine test code now being prepared by the American Society of Mechanical Engineers will use 19,350 Btu. per lb. of fuel as the reference value. From 1930 to 1947, the Diesel-engine industry in the United States has been using 19,000 Btu. per lb. as the standard heating value of fuel oil and all test and performance values were reported for 17 years on the basis of that value. With a new reference fuel heating value confronting everyone dealing with Diesel engines in the United States at least, one wonders if perhaps the answer after all isn't to recognize that fundamentally the Btu. is the thing we are talking about, throw all reference heating values in the scrap heap, and talk of engine performance on the basis of British thermal units.

Change our thinking? Certainly it will. But then who hasn't had his thinking radically changed by atomic bombs, atomic power plants, rocket motors, television, jet-propelled airplanes, and world-shattering political and economic upheavals resulting from World War II. Perhaps it is time that we even gave consideration to thinking in terms of fundamental engineering units when dealing with the performance of Diesel engines.

Consider for a moment what it would be like if we all agreed to express engine performance in Btu. (the basic heat unit) instead of in some hypothetical weight of a ficticious fuel. Consider for purposes of illustration, the individual buying an engine under the existing standards of DEMA, where reference fuel-heating value is based upon the international standard 19,350 Btu. per lb. high heat value, with the following fuel-consumption guarantees based on the reference fuel-heating value given in the contract.

Full load .....0.37 lb. per bhp.-hr.
¾ load .....0.37 lb. per bhp.-hr.
½ load .....0.40 lb. per bhp.-hr.

The engine is installed, and the purchaser buys fuel oil with a high-heat value of 18,800 Btu. per lb. Tests are run, and lo and behold the full-load test fuel consumption runs 0.378 lb. per bhp. hr. The test engineer does some hurried calculations, and finds that when corrected for the lower high-heat value of the fuel burned during test as compared to the higher high-heat value used as the basis of guarantees the engine performance is still better than guaranteed. Testing the engine is usually not that simple, however, because the fuel heating-value determination is usually made after the engine has been tested.

But to continue with the illustration. When the second shipment of fuel is received for use in the engine, the heating value is 19,400 Btu. per lb. As a consequence, the plant operator, if he is meticulous about his records of fuel used, discovers that his engine is doing a better job than it did during test—it is using fewer pounds of fuel per bhp.-hr.! Perhaps, but the odds are that the gain in efficiency is in no small degree a gain in the heating value of the fuel. When the third oil shipment is received, it may be from the same supply as the original batch (high-heat value 18,800 Btu. per lb.), and performance again drops. The foregoing illus-

. . . . *And now please turn to page 75* . . . .

* *Associate Professor, Missouri School of Mines and Metallurgy, Rolla, Missouri.*

THE BIG BRUSH-OFF

THE STORY OF TEXAS RANGE RECLAMATION

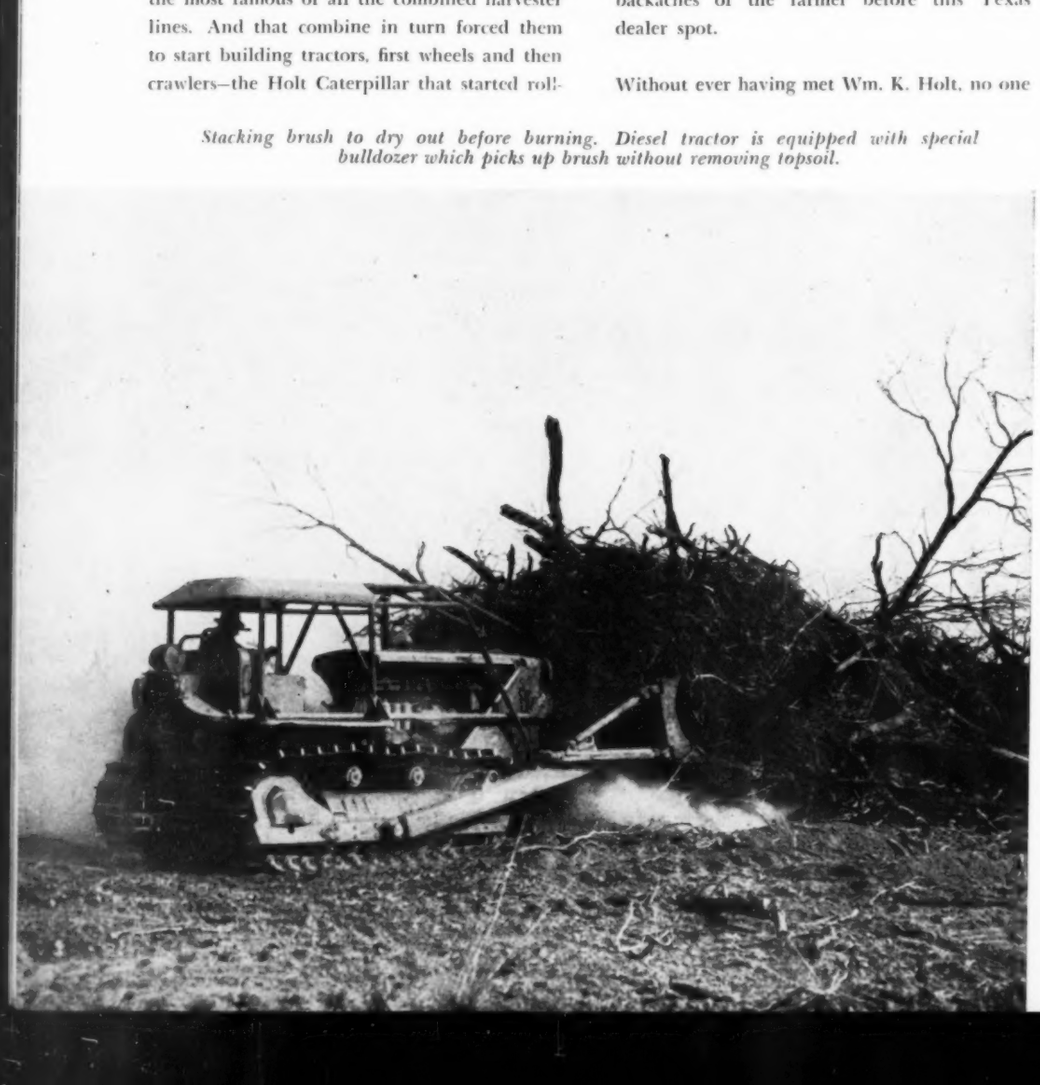
By F. HAL HIGGINS

A new angle in knocking trees down—Rancher J. D. Hudgin's Caterpillar tractor equipped with homemade extension crossblade fells 18 inch trees with one push.

WAY down deep in the heart of Texas with headquarters at an old frontier cow town called San Antonio is a pair of ex-California crawler tractor specialists in a dealership called Wm. K. Holt Machinery Co. Junior partner, vice-president and general manager is Howard R. Murphy, scion of an old apple-knocking family from the Parajo Valley. Senior partner and president of the team is Wm. K. Holt, son of Benjamin, most famous of the Holt Brothers, who came to California from Connecticut soon after the Civil War. The Holts developed their old New England wagon wood business into the most famous of all the combined harvester lines. And that combine in turn forced them to start building tractors, first wheels and then crawlers—the Holt Caterpillar that started rolling in 1905. Your Old Reporter has known the junior partner in this Texas dealership for twenty years. He has seen him operate as an agricultural tractor specialist, as a Yakima, Washington, dealer's manager; as a mail order farm implement salesman; and so on all over the U. S. map—Coast, Northwest, Mid-West. "Murph" was always in an "eager beaver" role of giving his last ounce for his Boss and the house and product he represented. Thus, Murphy had accumulated over 20 years of experience in retailing, manufacturing and designing tractor-powered machines to ease the backaches of the farmer before this Texas dealer spot.

Without ever having met Wm. K. Holt, no one in crawler tractor industry can get away from the name. It is a name that is indelibly stamped on crawler tractor history in peace and war. One digging into tractor history never gets out of sight of its influence in modern times. So, this Texas combination of Californians with inherited and accumulated know-how in tractors and tractor-operated tools is proving an ideal one in working out territorial problems to advance its farm, oil field and tax payers' interest. That they have done and are continuing to do so was proved by the writer's recent visit. Personal visits to leading Texas ranches, correspondence with U.S.D.A. Soil Conservation officials, perusal of the livestock and general farm papers of the Southwest, all yielded much information on range pasture reclamation by the new methods of mesquite and other brush and tree removal to reclaim millions of acres of virgin pasture lands for beef, sheep and goat raising. Back at the start of the recent world war, a conversation with Frank A. Nikirk, now with the International dealer in Albany, N. Y., revealed the pioneer work he did for the famous King Ranch of the Kleeberg family. Nikirk had been sent down to work out with the King ranch folks brush clearance with Caterpillar Diesel tractors. He had sized up the impenetrable mesquite brush that had been spreading over the King ranch to capture from the range cattle more and more of the pasture until the ranch was land poor and ready to go broke. Nikirk is a sound civil engineer with nearly a half century of railroad, street and highway engineering and equipment selling to solve dirt moving problems for ever cheaper and faster built transportation arteries. He solved the brush clearing problem for the Kleebergs with Diesel tractors until he left the machines sent down for trial on the job. Other big ranches copied

Stacking brush to dry out before burning. Diesel tractor is equipped with special bulldozer which picks up brush without removing topsoil.



the Kleeberg Diesel-powered equipment. The U. S. Soil Conservation Service took lessons and adapted the brush dozers and other tools to the various problems in this and other areas of the Southwest of Texas, New Mexico and Oklahoma especially.

So, when Manager Murphy of the Wm. K. Holt organization began walking through his block-long factory and service shop back of the offices and show room on the outskirts of San Antonio, the visitor began opening his eyes to what is happening in this field of reclaiming pastures for more livestock and taxes to support more farm and city populations in the Southwest.

The Wm. K. Holt shop is a factory for revolutionary brush-removing equipment in its test-

Veterans in the tractor business—Howard Murphy, General Manager (left) and William K. Holt, President of the Holt Machinery Co.

ing, or research, stages before going into production. The writer discovered that this Dealership owns and operates a test farm to prove out the new ideas and tools designed in its shop to increase sales of tractors and dirt moving equipment. But let our hero, the ex-Parajo Valley apple plucker, tell the story:

"A year ago," began Manager Murphy, "we bought a section of land in the brush for the purpose of having a proving ground on which to test new equipment before offering it to our trade. This farm is located in the Winter Garden section of Texas near Crystal City, the spinach center of the world, where a statue of Popeye reigns over the city park. The first program carried out on the farm was the development of a new root plow that would reduce draft and that had clearance enough to plow brush 12 ft. tall without removing the trees. We also worked out some brush-stacking attachments for bulldozers and angledozers and some improvements on the treedozer which was developed on the King Ranch by our company about 10 years ago. The next step in mechanizing the clearing of land for cultivation was to develop a root rake strong enough to follow the root cutter and pull out the stumps and heaviest roots later to be stacked and burned. The refinement of root raking is still being studied and we now have a D4 with Towner spring-tooth rake or cultivator which is being converted to direct connect type of implement to be used for the lighter root raking and subsequent farming operations.

"We have now assumed that the clearing of the brush and breaking of the land will be primarily a contractor's job for which the major tools have now been perfected and placed in production. All the pilot models are made in our shop and the first 10 plows have been made in our shop in San Antonio.

"The next development program was the selection of farming equipment for that irrigated area in the Winter Garden section. Experimentally, we bought a Ford tractor and the smallest Case tractor with planters and cultivators. A D6 and a D4 are doing the heavy work on this section of land and the small wheel tractors will do the light work, following L. J. Fletcher's thinking of 20 years ago, using tracks for the heavy work and wheels for the light work. We have already proved the land plane for leveling. This is the Pacific 10 ft. model. We have proved the Towner off-set disc harrow with Towner subsoiler and ditcher, the Towner heavy spring tooth harrow, the Schmeiser 'Till an' Pak,' the Be Ge land leveler.

The new Rocket chisel is ready to go out for test. Where most of the farmers on new land have gone one-crop, which, from an economical standpoint, is a gamble as to price, we are going to diversify. We are working with the Winter Garden Experiment Station, the seed and fertilizer companies, the U. S. Soil Conservation Service and the Texas Agr'l. College Extension Service in the selection of cover crops and fertilizers to improve the soil and have already made some definite progress.

"Water shortage is a great problem everywhere. We have brought in Shur-Rane over-head irrigation and have already proved that we can save half the water in gallons per acre and half the labor per acre. We have three wells 1200 ft. deep and pump our water 180 ft. to 200 ft. with Caterpillar Diesel engines. By using reservoirs, we are able to pump with D8800's, instead of using D13000's, although this is an experiment and we find it will be cheaper to use the larger engine.

"From our findings so far, we will grow new varieties of sweet sudan and hegari for seed we will grow some new varieties of peppers and possibly some fall melons. Spinach will be grown under three types of irrigation this fall with varieties of fertilizers used under various combinations.

"I think any machinery dealer, expecting to serve his customers over a long period of years should have first hand knowledge of what his equipment will do. I know of no better way to find out than to spend your own money under conditions comparable to the customer's."

Holt-built root rake, 16,000 lbs., pulled by Caterpillar tractor at the Holt and Murphy proving grounds near Crystal City, Texas.

DE LUXE DIESEL ELECTRIC FERRY "CH

By CHARLES F. A. MANN

"Chinook," latest addition to the Puget Sound Navigation Company's fleet—318 feet overall, twin screw, powered by four 16 cylinder General Motors Diesels each developing 1200 hp. This new car ferry will operate between Seattle, Washington, and Victoria, B. C.

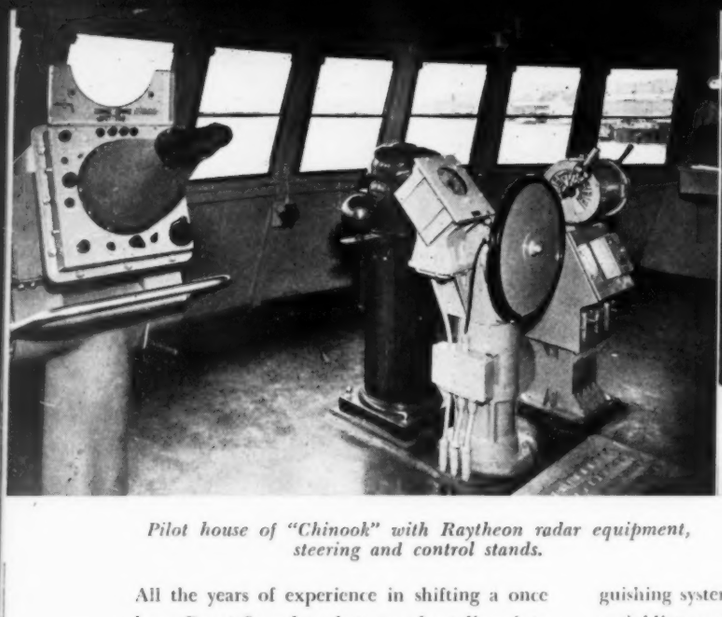
Y "CHINOOK"

ptain Alexander M. Peabody, President of Puget Sound Navigation Company, cutting thday cake on trial run.

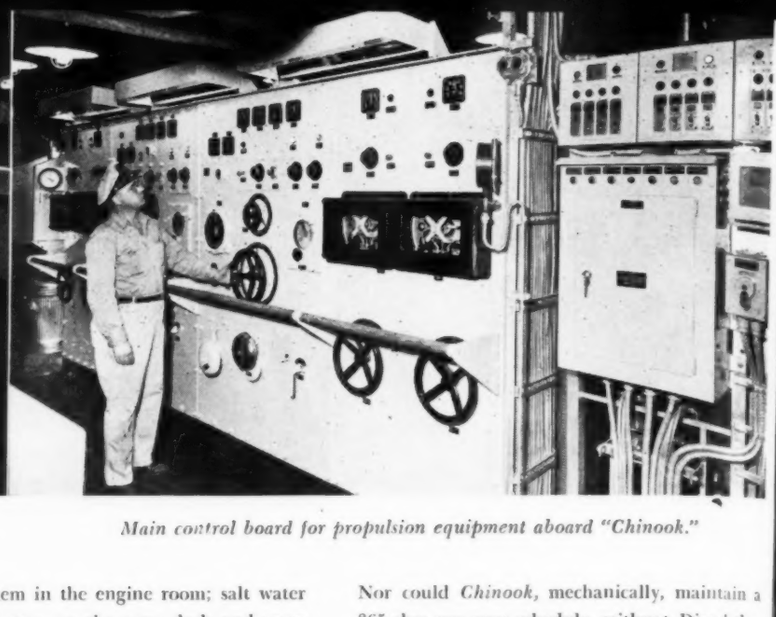
PUGET Sound Navigation Company—The Black Ball Line—of Seattle, innovator and operator of so many "firsts" in the Diesel ferryboat industry, and largest ferry company on the Pacific Coast, replaced the last of its big old-time steam ferries June 25 when the trim, Diesel electric ferry *Chinook* set out on her nightly run from Seattle to Victoria, B. C.

Last Fall, waterfront hecklers on Puget Sound snorted when Capt. Alexander Peabody, President of PSNCO, tersely announced that a New York firm, Gibbs & Cox, would design his newest nautical creation. "What does a New York firm know about designing a de luxe day-night passenger, mail, express and automobile ferry that has to be neatly built to compete with Canadian Pacific Princess steamers," they growled.

Nine months later, Gibbs & Cox, and the Seattle division of Todd Shipyards Corporation, likewise from New York, proudly showed *Chinook* to a delighted audience in both British Columbia and Washington State.



Pilot house of "Chinook" with Raytheon radar equipment, steering and control stands.



Main control board for propulsion equipment aboard "Chinook."

All the years of experience in shifting a once large Puget Sound packet steamboat line, into an even larger Diesel cross-Sound ferry line, along with the millions of miles piled up by the famed *Chippewa* and *Kalakala,* first two bigtime Diesel ferries in the whole U.S.A., and the 20 or more other sizes and shapes of Diesel ferries in the PSN fleet, were sifted and weighed, to produce *Chinook.* Proudly in every bit of news about her, the company emphasized the fact that *Chinook* not only was America's first large postwar vessel to be built and financed strictly by private capital—no Government loans or credit of any kind—and this $1,500,000 creation embodies about everything ever learned from inland and ocean vessel construction.

The entire vessel, essentially is a ship that was made possible by unique and ingenious design based on trying to build a vessel under today's terrific costs that could live out its service life without bankrupting its owner. Scarcely a detail of design or layout strays far from the Yankee ingenuity at licking this high-cost problem, right down to the use of CO_2 fire extinguishing system in the engine room; salt water sprinkling system on the auto deck and spun glass cloth for the drapery. Every piece of steel bar and plate was welded into place neatly and with proper curves and smooth joints, to permit constructing an entire ship of steel, and saving over $100,000 of expense in eliminating every bit of fireproof panelling on the entire ship interior. The saving on fancy interior panelling and making the ship about 97½% (by weight) fireproof, permits a drastic annual saving in fire insurance; permits continuous redecoration and freshening all passenger spaces with a simple application of a spray gun full of colored lacquer; reduces weight and gives the public a kind of Modern American ship decoration treatment in strict tune with the stern age of speed and steel.

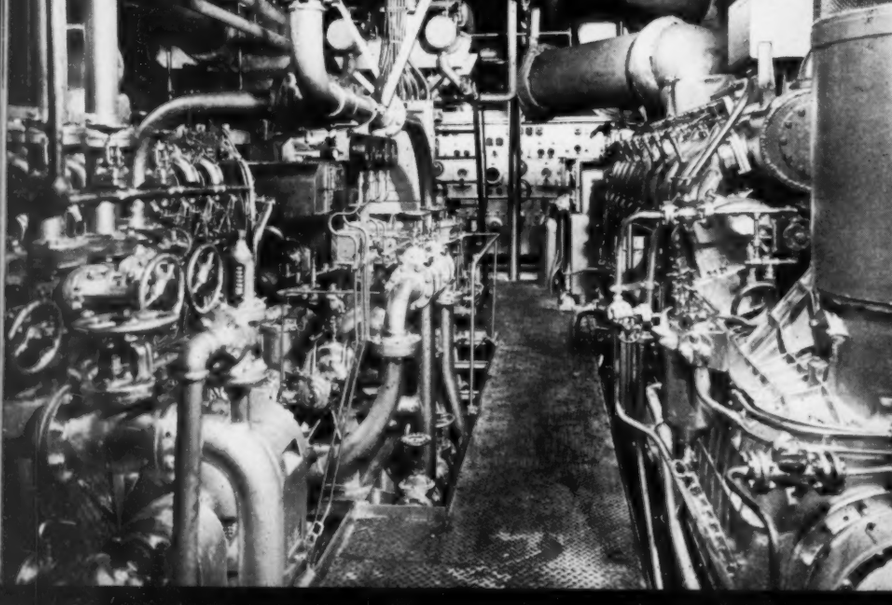
Warming to this subject of design, it can next be said that *Chinook* would be practically impossible, as she is now, with her light draft, light weight, compact layout, without lightweight Diesel electric propulsion and auxiliary power.

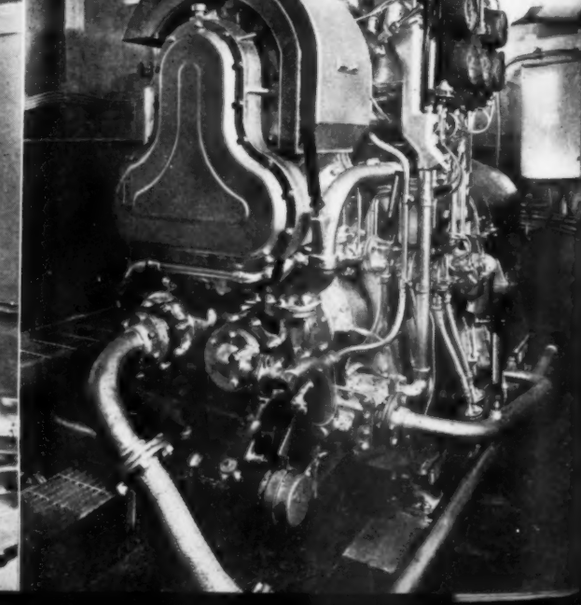
Nor could *Chinook,* mechanically, maintain a 365 day per year schedule, without Diesel-electric power. No time off is allowed for machinery repairs on this Victoria mail run. From 9:30 P.M. till midnight in Seattle or a few hours layover time in Victoria, is all *Chinook's* machinery can be stopped dead. Therefore everything below the automobile deck—a 6-lane ship's highway of solid steel throughout, is an duplicate, even to pumps; heating boilers, etc. *Chinook,* therefore, is not only America's but the world's first big-time ferry to be mechanically equipped to run 365 days per year without stopping.

Departing from the extreme streamlined design of her sister Diesel ferry, *Kalakala, Chinook* is ultra-modern. Every exterior curve and interior bulkhead, stanchion or girder carries a load and adds to the eye appealing charm. The broad, full-width pilot house carrying Raytheon Radar (radius 50 miles), Northern ship to shore telephone; electro-hydraulic dual steering gear and all the other equipment that make for safe, fast navigation on a closely timed

Main engine room of "Chinook." Control board (background) two of four 16-cylinder General Motors Diesels driving Allis-Chalmers generators (left and right).

General Motors auxiliary Diesel driving 100 kw. Century generator located on boat deck of "Chinook."





run like this, has a sun-visor around the front, that when viewed from the dock or passing ship, blends with the two stubby flying bridges —vital for use in Victoria's cramped harbor, the curved front of the Garden Lounge observation saloon and the modified clipper bow—relic of the Black Ball's Clipper sailing days tradition.

Built without sheer or camber, the hull lines are rather fine and easy to push along at 18 knots with the twin propeller drive. Large sponsons carry the hull abruptly to full 64 ft. car deck width. Length is about 318 feet overall and 13 ft. draft, when fully loaded. The lightness and compactness of the machinery, permits large voids in the lower hull to give buoyancy and plenty of room for everything. Two fuel oil tanks forward of the machinery space and one in the extreme aft, just ahead of the ballast and steering gear room spaces, give her a capacity of 63,710 gallons, or enough for a week's average running. Three tanks immediately after the machinery space, carry 29,590 gallons for culinary and hotel purposes.

Above this tank space, which occupies the ship's hull at either end of the machinery compartment, is the lower deck, a series of unused spaces forward, but used largely for the roomy comfort of the entire ship's crew aft of the machinery space. A large messroom, supplied by a dumb waiter to the galley on the boat deck; crew's staterooms on either side, together with washrooms, etc., followed by a large crew's recreation room, and passageways to the steering gear engine room, complete this lower deck.

Watertight bulkheads extending to the car deck, aft of the auxiliary machinery compartment and at the aft end of the main engine room, make *Chinook* a 3-compartment ship, virtually unsinkable in case of collision.

The automobile or main deck is a monster, starting with roomy Bosun's stores in the forepeak; a locked mail and express room, then a 6-lane auto space, with novel features. Because the Diesel machinery requires a very narrow trunk extending upward, the six car lanes are exceptionally roomy and permit easy passageways beside each lane of automobiles. The center lanes extend almost 15 feet above the specially constructed roadway plates. The two lanes on each side, have only a trifle over 7 ft. clearance, because of the novel "hanging decks" along each outer side. These "hanging decks" extending down into the auto deck from the promenade deck above, carry 25 staterooms along each side, plus a 4 ft. passageway, thus

"Chinook's" circular dining saloon located aft on upper deck offers good food and an unparalleled view.

giving *Chinook* three complete decks of staterooms instead of two, that would otherwise ordinarily result if the full 15.9 auto deck height would extend the full width of the ship. These 50 cabin-class staterooms are the low priced overnight accommodations, and are about 6.6 x 7 ft. in size each—just big enough for twin single beds; a Combolet and a wee vanity and an extra chair. Passenger access to these wing hanging decks is via enclosed stair hall from the promenade deck or the after open promenade space.

The promenade or main deck is novel in arrangement, containing the three big public lounges, entrance lobby and is banked with staterooms along the entire side. Wide promenade decks run outside the entire length of the ship.

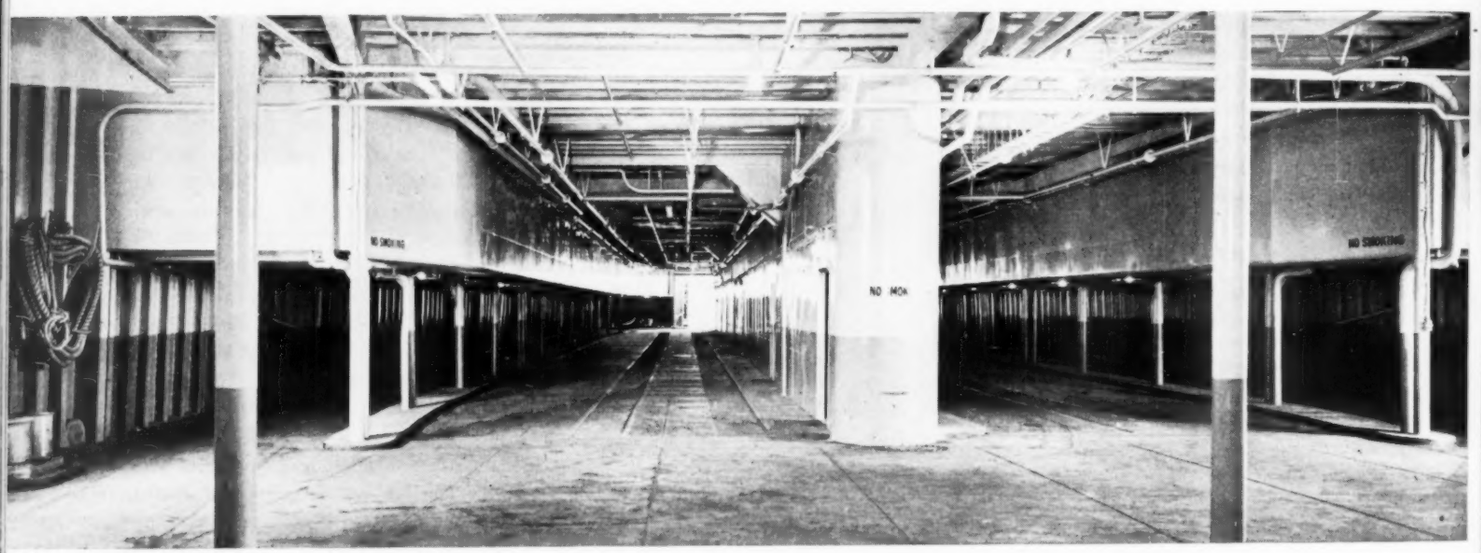
Forward is the garden observation lounge; next the entrance lobby, with its floating Customs office to facilitate international travel; the main salon amidships; and the after or ladies' lounge. Aft of this is a large promenade deck area, open to the breezes.

The boat deck carries the huge pilot house forward, raised above the rest of the deckhouse level. Space underneath the pilot house elevation forms a sort of dome over the garden lounge. Next is a grouping of officers' quarters. Then comes the stair hall; emergency generator room; fan-air conditioning room; coffee shop and the large sky-lighted galley and circular main dining room at the extreme aft part, facing another open promenade space, and the endless view astern.

The various startling and somewhat radical departures in ship design and layout, at once characterize *Chinook* as the "Queen Elizabeth

"Garden" observation lounge located forward on the main deck.

of the Inland Seas." Never before has so drastically revised interior arrangement been followed. All the machinery and crew occupy the space below the car deck. All the freight and automobiles center on the car deck, as well as up and down access to all parts of the ship. All public rooms are centered on a single deck. All food service and cooking occupy the highest, best ventilated and lighted part of the ship. Gone is burial of food down in the bowels of the ship along with the machinery. All foot passenger traffic centers at the passenger lobby, and you go up one flight or down one flight to reach all staterooms. Gone is the stuffing of odd rooms and facilities into a corner simply because there was a vacant space that needed filling, without rhyme or reason. The crew, the pedestrians; the overnighters and the steward's department as well as ship's officers, each work on a grouped level, which abolishes chasing all over the ship to get from one area to another.



Six-lane automobile deck of "Chinook" can accommodate approximately 100 cars and trucks. Two outboard lanes have 7½-foot clearance.

Main propulsion centers around 4 identical 16 cylinder Model 278-A 2-cycle General Motors Diesels, built by the Cleveland Diesel Engine Division. With cylinders having a bore of 8¾ inches and stroke of 10½ inches, they deliver their maximum power at 685 rpm. Each drives a 1200 hp. Allis-Chalmers generator rated at 490 volts at 700 rpm. The propulsion motors, 4 in number, are operated in pairs, two being geared to a single shaft, via Farrel Birmingham reduction gears, 1.81 to 1 ratio. Each motor is a Westinghouse 561 rpm., 490 volt D.C. unit. The twin motor drive sets turn an 8 inch propeller shaft, working through a Kingsbury thrust bearing built into the reduction gear. Normally they turn at 310 rpm. at top speed, each driving a three bladed 8 ft. 6 inch Coolidge propeller, and are rated at 2400 shaft horsepower. The twin-shaft unit gives *Chinook*, therefore, 4800 shp. at 310 rpm. Slow night runs can be made with but two of the Diesel sets if necessary.

In the auxiliary machinery room are two ships' service 300 hp., 8 cylinder 6½ x 7 General Motors Model 268 Diesel engines, delivering their rated output at 1200 rpm. These turn two Westinghouse 200 kw. 450 volt A.C., 3-phase, 60 cycle generators, for operation of the elaborate lighting system, ship's galley and the ventilating system, besides various motors in the engine room. Each has a 40 kw. D.C. 120 volt generator for special ship's control circuits.

Because of climatic conditions, the air conditioning system operates practically continuously, with some heat necessary throughout the year, including summer evenings. Two Cyclotherm 46 in. x 5 ft. oil fired heating boilers are fitted, each with power oil burner and a capacity of 2600 lb. of steam at 30 lb. pressure per hour.

Harrison lube oil coolers and Elliott oil strainers; 2 Sharples centrifugal oil purifiers and Harrison heat exchangers for the fresh water cooling circuits are fitted. Jacket water circuits are controlled by Fulton sylphon thermostat valves. Blackmer fuel transfer pumps are fitted.

In the emergency generator room on the boat deck, under the stack, is a third Diesel generator set that cuts in to maintain light, control, radio and Radar circuits in case of flooding of the auxiliary compartment. This set consists of a three cylinder General Motors Diesel and a 100 kw. Century electric generator. This set cuts in automatically when the regular generators fail.

All deck machinery is electric. A pair of electric-hydraulic steering engines are fitted for the twin rudders. Fast steering is obtained with the rudders directly in the propeller slip streams. Hand emergency steering equipment is fitted on the top of the after end of the boat deck.

Chinook joins one of the world's largest passenger and auto carrying fleets of ferries, as the world's most modern, craftily designed inland waterway vessel. So "ultimate" has the design been worked out, that many of the features and design as well as machinery "firsts" will be widely copied throughout the world. Her predecessors rolled up nearly 3,000,000 miles in 42 years' service, and it is fitting that the largest Diesel ferry yet built in America, the first big Diesel electric ferry of her type should follow on this historic route.

No wonder she has been called "Queen Elizabeth of the Inland Waterways."

CANADIAN-BUILT YACHT *ARBEE II*

View of control stand located in "Arbee II's" deck house. Bendix throttle and clutch controls can be seen.

"Arbee II" new 52-foot Diesel yacht, propelled by 162 hp. Cummins Diesel, built by Russet Brothers Limited in Canada.

CANADIAN yachtsmen should be very proud of what is probably the largest and most luxurious steel Diesel yacht ever built in Canada. The *Arbee II* was designed by J. Murray Watts & Company of Philadelphia, Pa., and built by Russel Brothers Limited of Owen Sound.

General construction called for an all-welded steel hull and decks with a rivetted aluminum deckhouse. The general dimensions are as follows–Length 52 ft. 3 in., breadth 14 ft. 4 in. and a designed draft of 4 ft. Particular care was given to the method of removing the mill scale from the exterior of the hull and deck plating. Several methods were tried such as flame scaling, burnishing with emery discs and an acid bath, and this final procedure proved quite successful. The bright steel was then given two coats of zinc chromate for protection before the finish colours. International marine paints were used throughout, giving the final combination as follows – Bottom, dark blue; hull and sides and lower section of the deckhouse, silver grey; deckhouse upperworks, sea blue. With the hand rails and deckhouse trim in natural mahogany, and with chrome deck fittings, the *Arbee II* is a very smart vessel.

Fibre glass insulation was used between hull shell and decks and interior plywood finish, also sound-proofing the engine room, bulkheads and deckhead. All interior accommodation is finished in birch plywood with ivory semi-gloss enamel and natural mahogany trim.

The accommodation forward to aft consists of crew's quarters; two-berth guest cabin; galley starboard and bathroom port; engine room with deckhouse over; owner's two-berth cabin complete with bathroom and shower. Some special features of accommodation equipment include –electric toilets, pressure fresh water system, oil-fired hot water heating, oil fired "Shipmate" galley range, deluxe combination stainless steel ice and electric refrigerator, designed and built by the builders and fitted with Frigidaire cooling unit. The galley also had a stainless steel dresser top. The deckhouse is fitted with a studio couch to make an extra double berth, or in the daytime, a day lounge seat for the dinette. All owners and guests quarters as well as the deckhouse are fitted with broadloom carpet.

The electrical system is all 110 volt DC with an AC shore connection for all cabin lights and fixtures. Power is maintained by a 5 kw. Kohler gasoline generating set. The main propulsion consists of a Cummins supercharged six cylinder Diesel engine, developing up to 162 hp. at 1600 rpm. and fitted with a 2:1 reduction gear. The propeller shaft is stainless steel and turns a Kennedy 3-blade nickel steel 28 in. x 30 in. propeller. Auxiliary propulsion is provided by a Chrysler Ace gasoline engine, direct drive on a stainless steel shaft and fitted with a Hyde 18 in. bronze two-blade feathering propeller. Fuel capacity consists of 500 Imperial gallons of Diesel oil and 200 gallons of gasoline. Fresh water tanks provide 360 gallons, stored in the aft peak in two monel tanks. The hot water heater is a "Preferred" Model 400 yacht heater, oil burning with automatic controls. Hot water heating system is filled with a solution of Prestone to simplify winter storage.

Ventilation to the living quarters is natural through ports and windows, all fitted with bronze screens. The engine room is ventilated through two six inch cowl vents of which the exhaust side is fitted with a blower and duct work connected to the bilges and battery box. Bendix throttle and clutch controls are fitted to both main and auxiliary engines; control stations are located in the deckhouse and flying bridge. Russel "Steelcraft" hydraulic steering gear with 1½ in. rams, is fitted aft with dual controls in the deckhouse and the flying bridge. On the forward deck is installed an Ideal electric windlass for the anchor.

The home waters of this yacht are the Georgian Bay, but it is salt water equipped to permit the owner to make winter cruises to Southern waters.

DIESEL ENGINE DEVELOPMENT IN GERMANY

INJECTION PUMPS AND NOZZLES

PART I

By KALMAN J. DE JUHASZ*

IN this article mainly the injection equipment of large Diesel engines will be treated, such as have been employed in stationary and ship engines in Germany, shortly before and during the war. A few non-German developments, and also injection equipment for small high speed engines have been also included in view of their possible interest for the American Diesel engine industry.

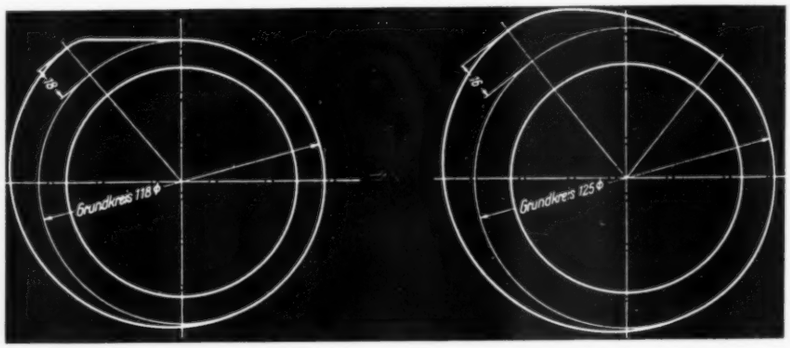
In large engines, such as used in cruisers and large submarines, mainly port controlled pumps of the Bosch type were used, but to a lesser extent also valve controlled pumps (with spill valve). The pressure actuated Archaouloff pump has also received some attention and developments were made on it.

While the dimensioning of pumps does not differ markedly from American practice, the following numerical values (based on data by F. Mayr, Chief Engineer of Maschinenfabrik Augsburg Nuernberg, M.A.N.) may be of interest.

The maximum fuel delivery is determined from the fuel consumption at maximum load which is in the range of .360 to .420 lb. per bhp. hr. (165 to 190 gm./bhp. hr.). Large, slow speed, and four cycle engines approach the lower, and small, high speed and two cycle enignes approach the higher value. For valve type pumps 70 per cent, for port controlled pumps 60 per cent, volumetric efficiency is assumed. At full load only about 60 per cent of the swept pump volume is utilized. The minimum delivery of the pump for zero load condition, for which the governor must provide, corresponds to 0.01 gram fuel per liter cylinder volume, which is equivalent to about 1/80,000 of the cylinder volume.

The ratio of plunger diameter to plunger stroke is governed by the following considerations. Advantage of large diameter and short stroke: shorter height for pump; disadvantages: larger circumference therefore greater leakage and less volumetric efficiency, also greater unequality of zero-load delivery. Empirical values: plunger dia./plunger stroke = 0.6 to 2.0 for valve type pumps, 1.0 to 2.0 for port controlled pumps.

Regarding cam design, the following basic considerations hold good. In the case of undivided combustion space (direct injection), the duration of injection (in terms of crank angle) should be as short as possible; for full load the attainable minimum is about 18 deg. crankangle, and the permissible maximum is 30 deg. In the case of divided combustion space (precombustion chamber and air chamber engines), the duration can be somewhat longer, roughly 25 to 35 deg. crankangle. Empirical values for plunger velocity during delivery: for four cycle engines 27 to 47 in.sec.$^{-1}$ (0.7 to 1.2 m.sec.$^{-1}$); for two cycle engines 39 to 63 in.sec.$^{-1}$ (1.0 to 1.6 m.sec.$^{-1}$). During the actual pump delivery the plunger velocity should be constant, or increasing; the maximum plunger velocity should prevail at the end of the delivery.



Figures 1 and 2. (Left) Injection pump cam for 4-cycle engine. (Right) Injection pump cam for 2-cycle engine.

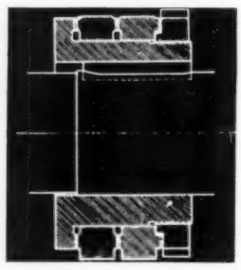


Figure 3. Method for altering pump timing; sleeve is keyed to camshaft and engages with serrations on face of cams.

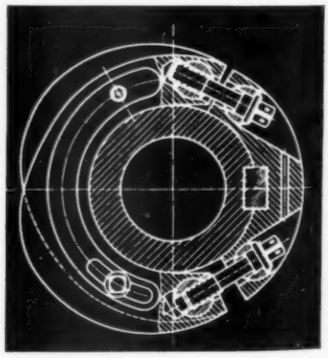


Figure 4. Method of altering pump timing; part of cam ring is keyed to camshaft and connected to cam proper by adjusting bolt

In four cycle engines the camshaft speed one half of the crankshaft speed, and therefore a given plunger velocity necessitates a steeper cam than in the case of a two cycle engine and may result even in a concave cam; from these considerations the maximum permissible plunger velocity should be lower than in the case of a two cycle engine. Concave cams

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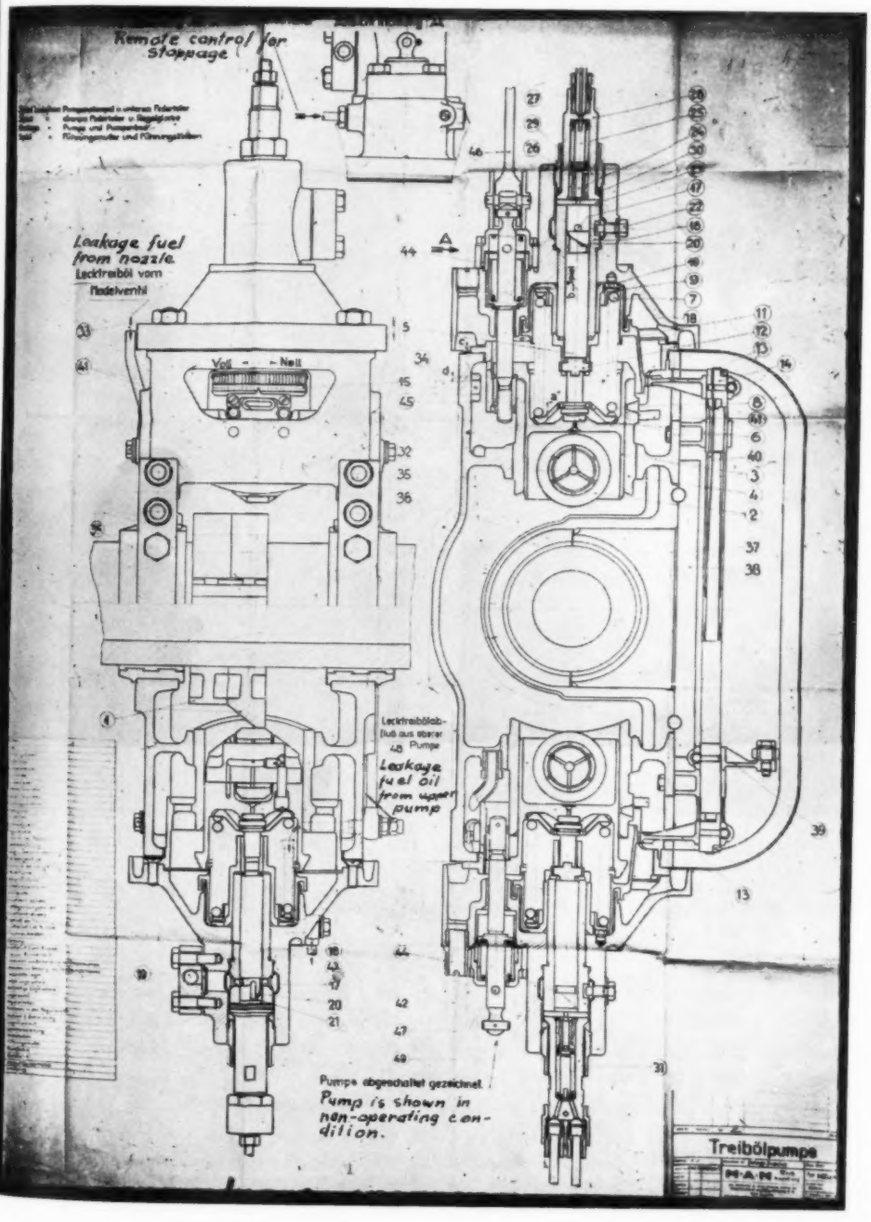
* *Professor of Engineering Research, The Pennsylvania State College (Scientific Consultant, Technical Industrial Intelligence Division, Department of Commerce)*

to be avoided for reasons of high forces and production difficulties. Examples of cams for four-cycle and two-cycle engines are shown in Figs. 1 and 2, respectively.

Provision has to be made for the adjustability of the beginning of delivery for two reasons. It is practically impossible to determine the optimum injection timing before the engine is built, and the final adjustment has to be made during the test run. Furthermore, the optimum timing depends also on the fuel used, and the timing must be changed whenever the fuel is changed. Two design methods to accomplish this are shown in Figs. 3 and 4. In the design show in Fig. 3, a sleeve is keyed on the camshaft, upon which are located the two cams for forward and reverse running. The side faces of the sleeve and also of the cams are machined with fine radial serrations fitting into each other, whereby the relative positions of the cams can be changed in increments of about 2 degs. In the design shown in Fig. 4, the cam ring is composed of two parts, one part being keyed to the shaft, and the other part, the cam proper, being displaceable relatively to the first part by means of two adjusting bolts, as shown.

Figure 5. Injection pump for M. A. N. double acting two-cycle Diesel. This drawing is reproduced from photostat of original plans.



The injection pump for the M.A.N. double acting, two-cycle engine, Fig. 5, is of the port controlled intake and spill type, similar in principle to the Bosch pumps. The interest of this pump resides in its large size and in the numerous refinements incorporated in it. The pump shown is of 25 mm plunger diameter; it is understood that pumps of this general design have been built up to 38 mm plunger diameter.

On the camshaft are arranged two cams (1), one for ahead and the other for the astern direction of rotation. The cams are made of two parts in a manner similar to that shown in Fig. 4: one part is rigidly keyed to the shaft and the other, the cam proper, is connected to the fixed part by means of tangentially acting screws and can be adjusted within certain limits for the purpose of setting the beginning of the injection for each cylinder. This setting is carried out when the engine is tested. After the cam is adjusted to the correct setting, no further adjustments are made.

The cam actuates two pumps: the upper pump serving the top side, and the lower pump serving the bottom side of the cylinder. When the engine rotation is to be reversed, the camshaft is shifted axially so as to bring the other cam into engagement with the tappet rollers (2). In order to allow this axial shifting, both cams and also the tappet rollers are beveled on their sides. Between the tappet roller (2) and its non-rotatable, hardened steel axle, a floating bushing of special bronze is interposed in order to assist in the lubrication and to distribute wear.

The tappet (3) is of steel and is fitted in a bronze bushing (4). The tappet motion is transmitted to the plunger (5) by means of the button (6) of hardened steel. The return spring (7) rests on the lower spring plate (8) which in turn rests on the inside of the tappet (3). There is a clearance of about 0.1 mm at the point "a" so as to allow the easy rotation of the plunger (5) by the governor gearing. The upper spring plate (9) rests on buttons (10) so as to relieve the regulating bell (11) of any axial and frictional force and allow its easy rotation. There is a small clearance of about 0.1 mm also at "b." The regulating bell (11) engages the flattened portion (12) of the plunger (5) by means of a forked extension, in the usual manner. The regulating bell (11) is formed, on its skirted portion, with gear teeth which engage with a geared segment (13) actu-

ated by the regulating shaft (14). The regulating bell (11) carries a graduated dial (15) fitted with a stationary index fixed to the pump housing, whereby the actual quantity setting of the pump can be observed.

The plunger (15) is fitted into the barrel (16) which latter is provided with two opposed apertures (17) serving for intake and spill. The fuel is introduced into the pump housing (18)

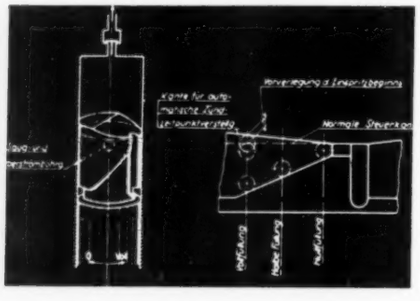


Figure 5A. Method for advancing the beginning of fuel delivery with increasing amount of delivery.

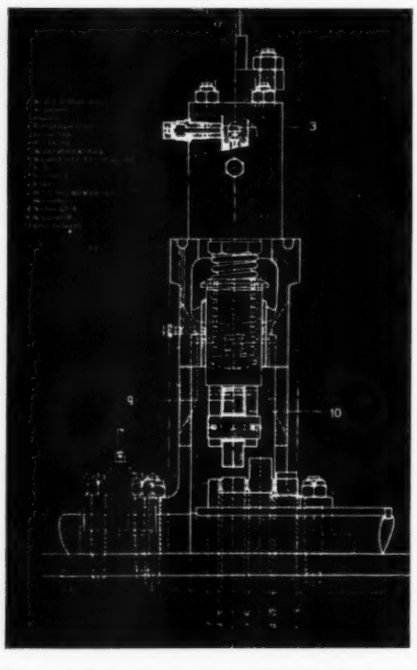
through the attachment (19). A hardened steel ring (49) protects the pump housing from erosion by the spill fuel. The barrel (16) is closed at its upper end by a flat-lapped plate (23) of hardened steel having an aperture in its center, which plate serves as a seat for the delivery valve (24). The lift of the delivery valve (24) is limited by the stop (25) serving also as a guide for the delivery valve spring. The delivery valve (24) is fitted into the guide (26) which has a fairly close fit within the hollow pressure union (28). The pressure fuel must pass through the narrow annular gap between the upper edge of the guide (26) and the inside diameter of the pressure union (28). This narrow gap serves as a filter to prevent impurities in the fuel from reaching the injection nozzle. The pressure union (28) is secured to the pump body by means of the hollow screw (29) and copper gasket ring (30) in the usual manner. The upper pressure union (28) is fitted with one fuel line for the top nozzle, and the lower pressure union (31) is fitted with two fuel lines for the two bottom nozzles. In view of the short fuel lines made possible by this construction it has been found satisfactory to serve two nozzles by one pump.

The pump bodies (18) are fastened with screws (33) to the camcase (32) which in turn is mounted to the engine cylinder middle pieces with screws (34). The camshaft is journaled in the two piece bearing (36) and (37).

The regulating shaft (14) carries on its two ends the gear segments (13) and in its middle the lever (39). All the levers (39) are connected to one regulating rod, serving all the pumps. The gear segments (13) are connected to the regulating shaft by means of torsionally elastic blades (40) so as to prevent locking of the entire regulating system if one pump plunger should seize because of grit or other reasons.

Each pump unit is lubricated with high pressure oil through two lubricating oil connections at (41), one of which lubricates the tappet (3), and the other the tappet roller (2) through suitable bores in the roller axle.

Provision is made to prevent mixing of the run-off fuel oil (which is carried away at "43") and of the overflowed lubricating oil (which is carried away at "42"). The upper and lower pumps are connected with the leak fuel pipe (48).



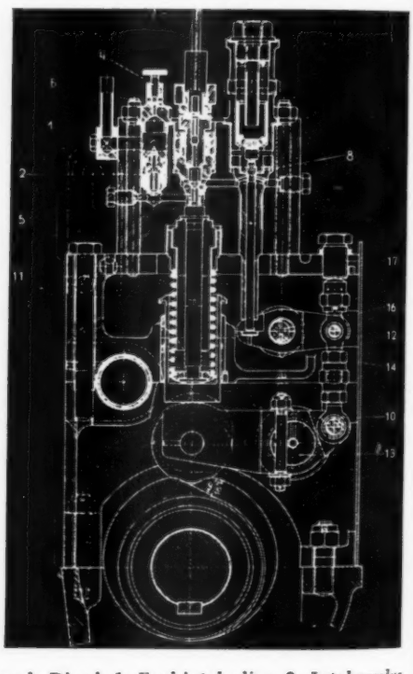


Figure 6. Injection pump for M.A.N. single acting 4-cycle Diesel: 1—Fuel intake line. 2—Intake valve. 3—Finger for holding intake valve open. 4—Air release screw. 5, 6—Delivery valves. 7—Fuel delivery line. 8—Spill valve. 9—Roller. 10—Forked lever. 11—Spring. 12—Lever for spill valve. 13—Lever fulcrum. 14—Adjuster element. 16—Governor shaft. 17—Adjusting screw.

In case of emergency the fuel supply to all cylinders can be quickly cut off by lifting simultaneously all plungers off their cams and thus rendering all pumps inoperative. This is accomplished by the emergency speed governor which permits compressed air to pass under the spring loaded piston (44). The piston rod of piston (44) carries a nut (45) which engages with the upper flanges of the tappet (3), and lifts the tappet out of engagement with the cam. With the aid of lever (46) it is also possible manually to make any one pump inoperative for a short time, or permanently, by securing the piston rod in its upper position by means of pin (47). The same lever (46) can be used for priming the pump. A gap of about 1 mm must be provided at "d" when the tappet is in its lowermost position.

As stated above, the setting of the beginning of injection is accomplished by adjusting the angular position of the cam on the camshaft. By this procedure, however, both upper and lower pumps are influenced at the same time. In order to provide for the adjustment of the upper or of the lower pump, shims can be placed between the pump body and the cam case at "c," whereby each pump body can be brought closer or farther from the cam. In some cases it is desired to advance the beginning of injection with the increase of delivery. For this the upper edge of the plunger may be cut at a slant as shown in Fig. 5a.

The injection pump for the M.A.N. 4-cycle engine of 17.7 in. dia. x 23.6 in. stroke (450 x 6000 mm), Fig. 6, is of the valve-controlled type having a diameter of 0.79 in. and maximum

stroke 0.71 in. (20 x 18 mm). It receives the fuel from a supply pump at about 14 psi pressure. The intake valve (2) can be held open by means of the finger (3) for eliminating air from the system through the air release screw (4) which is located at the highest point in the system. Two delivery valves (5) and (6) are used in series in order to prevent the back flow of fuel. The delivery is terminated when the spill valve (8) is opened. It is to be noted that this valve (8) is acted upon on its underside, by the full pump pressure, and it is loaded by a strong spring. Furthermore, this valve releases fuel from the passageway between the two delivery valves, and not from the pump space. The spill valve is actuated by the roller arm (10), through the adjustable connecting rod (14) and lever (12), the fulcrum (16) of which latter is capable of being moved by the governor, whereby the phase of opening, and hence the amount of delivered fuel is regulated. The fuel leakage is collected in a horizontal trough-shapd wall within the pump housing, whence it is carried away by a drain pipe. The cam throws the lubricating oil to the operating parts, and also to an oil hole on the upper surface of the roller arm (10) whence the lubricating oil flows to the fulcrum and to the rollers.

The injection pump for Krupp-Germaniawerft engine Fig. 7 is also of the valve-controlled type; in this case, however, the intake valve B acts also as the spill valve, which somewhat simplifies the construction. The functioning is clear from the drawing and the caption.

The injection pump for Burmeister and Wain, A.S. (Copenhagen, Denmark), double acting two-cycle engine Fig. 8, is of course, not a German but a Danish development, but it is thought desirable to include it in view of its interesting features. It is of the port-controlled intake and spill type; some of the features deviating from the usual practice are the following:

a. There is no separate barrel, but the pump body itself is fitted with a hardened steel liner permanently pressed into the pump body.

b. There is no delivery valve; the injection nozzle functions as the delivery valve. Owing to the shortness of the injection tube this arrangement has been found satisfactory.

c. There is a "shock absorber" chamber provided for eliminating the surges caused by the high pressure spill fuel.

d. There is a de-aerator drain pipe in order to liberate air which may accumulate in the pump chamber after a long period of standing.

e. The delivery pipe is connected to the pump by means of a screw and ball connection, which construction results in a somewhat shorter pipe than is attainable with the usual cone and socket connection, and permits greater ease in removing the pipe.

f. Tappet roller runs on needle bearing.

The balance of Professor DeJuhasz's article, with bibliography, will appear in the next issue of DIESEL PROGRESS.

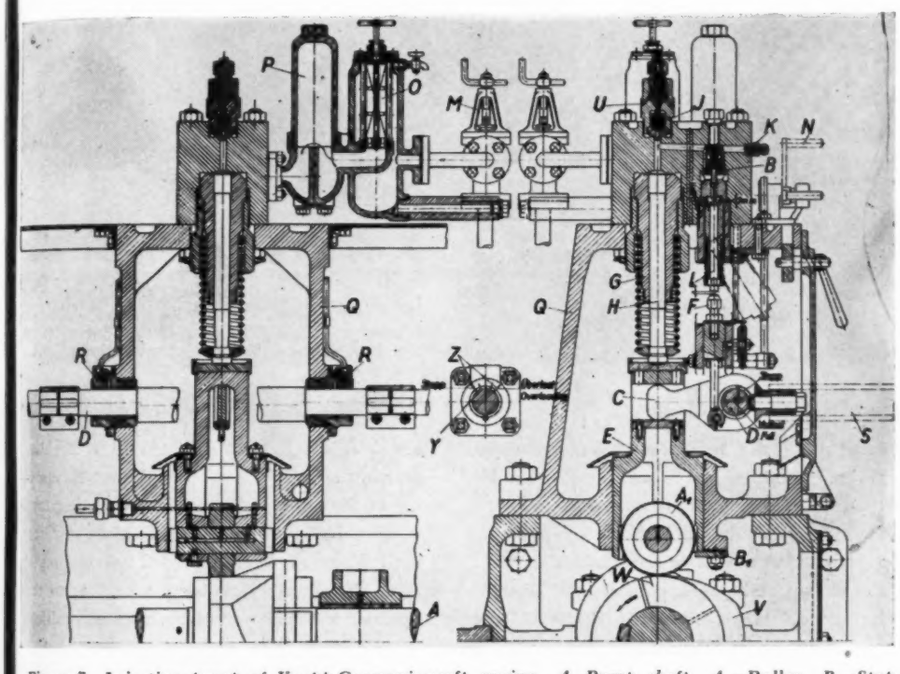
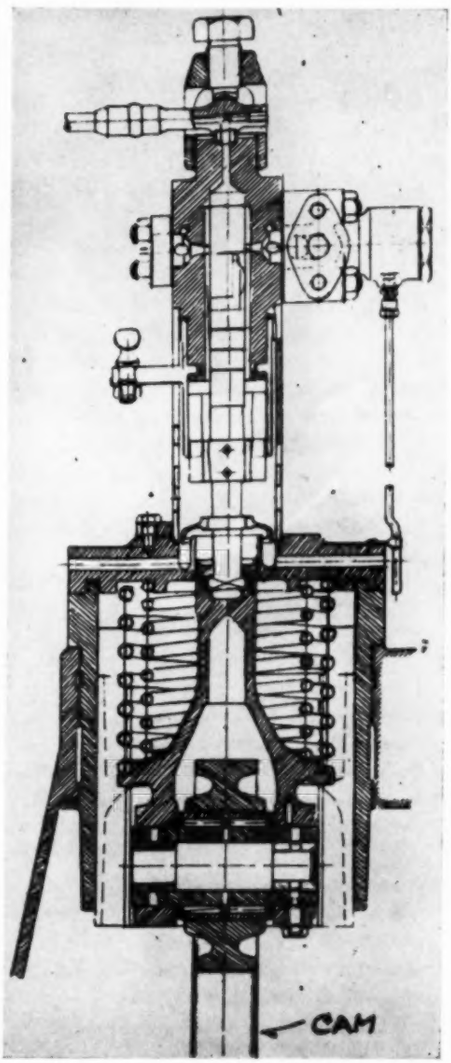
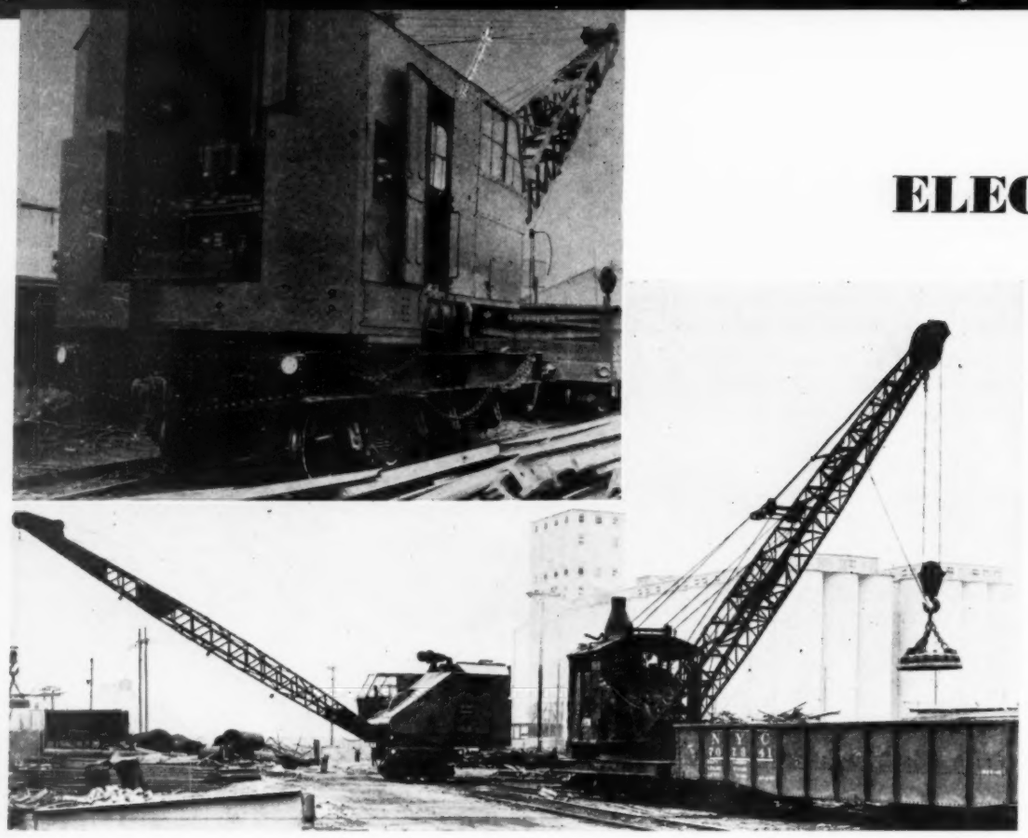


Figure 7. Injection pump of Krupp-Germaniawerft engine. A—Pump shaft. A_1—Roller. B_1—Stop for Tappet. B—Intake and spill valve assembly. C—Lever for actuating spill valve. D—Fulcrum for C (adjustable by governor). E—Adjustable lifter screw to actuate spill valve tappet. G—Pump bushing. H—Pump plunger. J—Delivery valve. K—Closure screw. M—Fuel supply valve. N—Stop lever. O—Filter. P—Surge tank for intake fuel. Q—Pump housing. R—Bearing for governor shaft. S—Pump lever, manual. V—Cam with index mark W.

Injection pump for Burmeister and Wain double acting, two-cycle Diesel.





ELECTRIC CRANE REPOWERED

by WILFRED H. LUSHER

Recently repowered by a Cummins Diesel, McMyler Interstate railroad crane (left) is seen with one of two steam cranes (right) at the yard of the Texas Steel Company. Insert (upper left) shows Dieselized crane which is equipped with a 150 hp. Cummins Diesel and Twin Disc hydraulic torque converter.

DIESELIZATION of an old electric yard service locomotive crane, with a resulting multiplication of both track and hook speeds and added versatility, has proved highly profitable for the Texas Steel Company, Fort Worth, Tex. In anticipation of greatly increased steel tonnage and a need for more effective crane service. Texas Steel repowered an obsolete 35-ton McMyler-Interstate Electric Crane with a Cummins Diesel engine and placed it in service alongside two oil-fired steam locomotive cranes in the plant. It is being used for unloading raw materials, loading finished products of the rolling mill, and switching cars in and out of the plant.

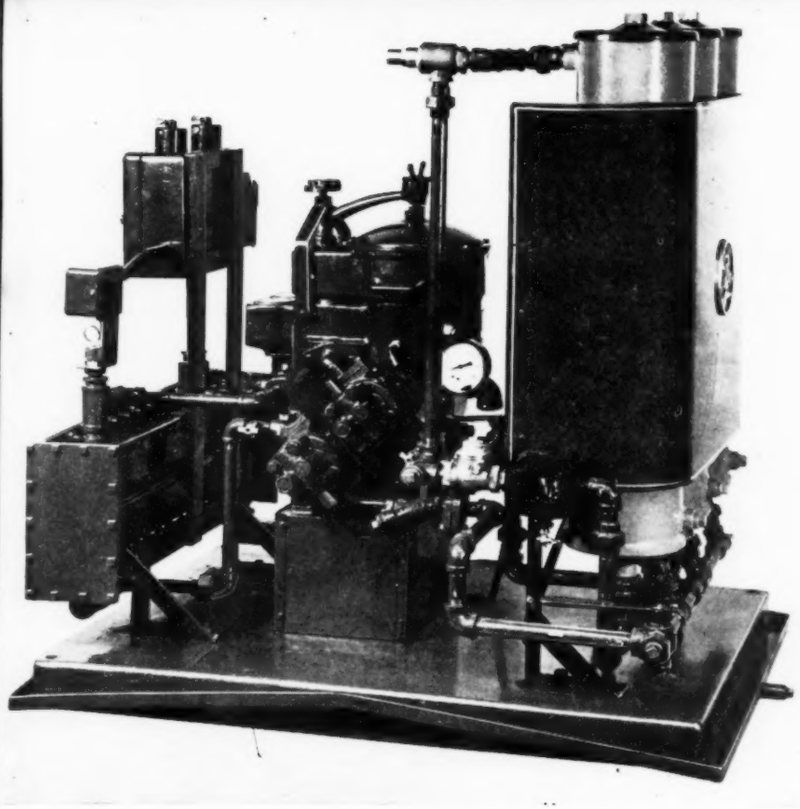
The repowered crane not only has given more effective and satisfactory service than when it was new and powered by electricity, but crew members report that the traveling, hoisting and swinging speeds of the Cummins-powered machine is nearly double that of the steam cranes. The McMyler-Interstate Crane originally was equipped with a 75 hp. wound induction motor for traction and hoisting power, and a 35 hp. motor to provide independent swinging power. A gasoline unit was installed to move the machine from job to job. Before Dieselization, it was necessary to place electrical outlets at each job location to provide power for the motors. This made car switching impractical, although it was possible for the machine to do hook work in one spot.

Recognizing the need for additional crane service, Superintendent Thruman Killman instructed his engineering department to investigate the possibility of obtaining a new Diesel-powered crane to replace the old McMyler and also to inquire into the possibility of Dieselizing the old crane. Estimates indcated that the repowering might be accomplished with a smaller investment than would be required to purchase a second-hand Diesel crane. Under the direction of the company's chief engineer, Phil H. Edwards, now in private engineering practice in Fort Worth, the repowering job was carried out by the plant.

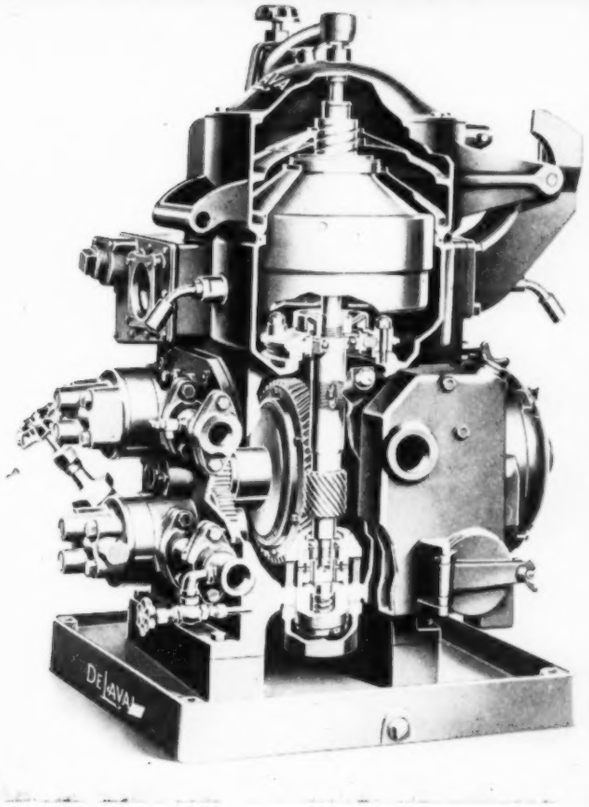
A Cummins Diesel engine, which develops a maximum of 150 hp. at 1800 rpm., was purchased from the Mid-Continent Supply Company of Fort Worth, and installed in the rear of the cab. The comparatively high-speed engine was chosen for the installation in order to provide maximum operating flexibility with the ratios originally in the rig. Throttle control is accomplished by the use of a variable speed hydraulic governor, thereby leaving the operator free of throttle adjustment for the delicate job of spotting and hooking. The engine is equipped with a Twin Disc Hydraulic Torque Converter from which a jack shaft is driven through an oil-bath roller chain. The 75 hp. electric motor and control were removed and the jack shaft installed in its place. The swinging gear is actuated by a reversing countershaft assembly with friction clutches and is driven by a roller chain from an idler gear in the main driving gear drain. Revamping of the cab and relocation of the operator's seat provides a greater range of vision. Operating controls also were relocated and improved in order to make them more accessible to the operator who now works from a seated position.

Speed torque curves, based on data from actual yard tests, show that the maximum track speed has been increased from 1.2 mph. before rebuilding to a present speed of 9 mph. Draw bar effort was increased from approximately 6,000 pounds to more than 15,000 pounds. Hook speed, too, was increased many times through Dieselization of the machine. The previous maximum speed with a two-part line of 36 feet per minute has been increased to 268 feet per minute under the same conditions. With the Cummins Diesel engine operating at 1200 rpm., hoisting and swinging speeds are more than sufficient to keep pace with an experienced operator.

Over a one-month period, fuel consumption for general yard work averaged approximately one gallon per operator hour. This included time spent in performing the greater part of the car spotting and switching. The cushioned torque applied to the rig by the Twin Disc unit and the fact that the engine cannot be overloaded or stalled are expected to result in comparatively low engine and rig maintenance.



The De Laval "Puri-Filter" combining centrifugal force and micronic filtration removes dirt, water and colloidal carbon.



Sectional view of De Laval "Uni-Matic" oil purifier, showing bowl driven by gear and pinion directly from motor.

THE CENTRIFUGE AND OIL CONDITIONING

PART II—THE DISC BOWL

IT is a far cry from the modern De Laval "Puri-Filter," the unit which makes it possible to purify Diesel lubricating oil by a combination of centrifugal force and micronic filtration, to the 1878 experiments of Dr. Carl Gustaf De Laval. Dr. De Laval, a Swede with a French name, in that year patented his first continuous centrifugal separator. This first machine was equipped with a bowl or separating chamber proportioned wider and lower than the present De Laval bowl. It was the original "hollow" bowl, consisting merely of the shell and a couple of wings placed opposite each other at the periphery which caused the liquid to rotate with the shell itself.

The first "hollow" bowl was improved upon somewhat from time to time until the year 1886 when Dr. De Laval filed an application for a patent covering the first tubular bowl. Soon Dr. De Laval had advanced his design of the tubular bowl to the point where it was long and slender in shape, and due to the greater length of travel through the bowl, the liquid was exposed to the action of centrifugal force for a longer time, thus further increasing separating efficiency. Despite this obvious advantage, the tubular type bowl was far from perfect, and had a disadvantage in that its small diameter involved operating it at a very high number of revolutions per minute in order to develop sufficient centrifugal force to effect separation.

Dr. De Laval then developed the bowl which today is known as the disc type bowl. From 1890, the basic De Laval bowl has been the wide bowl revolving at a speed sufficiently fast to develop maximum practical centrifugal force and still retain the stability required for continous trouble-free operation, even on board a ship in a sea way.

After more than 50 years of building centrifugal separators, The De Laval Separator Company has never gone back to its early long hollow bowl experiment but has continued to develop the disc type bowl.

The discs in a De Laval Centrifugal Oil Purifier bowl perform the same function as many partitions would in a settling tank, i.e., they divide the liquid into a large number of thin layers, thus greatly increasing the rapidity and effectiveness of purification. Particles of dirt travel through a film of liquid only 50/1,000 of an inch in thickness—the space between two discs. In the illustration, Figure 7, only a few discs are shown for the sake of clarity. Actually, there are 30 to 40 discs in the types of bowls used to separate Diesel lubricating oil.

Dirty oil, possibly mixed with water, enters the bowl through the feed tube at the top of the machine and passes down the tubular shaft to the bottom of the bowl where it is distributed upward through holes in the discs.

The space provided for the storage of impurities is outside the discs themselves, thereby enabling the bowl to operate at constant efficiency, i.e., with no reduction in centrifugal force even though the dirt-holding space is com-

pletely filled at the end of a run. This is an advantage which the early De Laval so-called "hollow tube" bowl did not possess for in that type of bowl the removed impurities remained in the zone of purification.

The De Laval disc type bowl has another advantage—it will continue to purify oil satisfactorily even where there are wide fluctuations in the amount or proportion of water in the oil flowing into the bowl. The relatively large diameter design of the De Laval bowl permits such fluctuations with a minimum disturbance of the liquid balance. This is of especial advantage on the high seas where when purifying Diesel oil it is of great importance that the oil purification system remain in continuous operation affording complete protection at all times, and handle varying amounts of water without stopping the bowl to change discharge rings.

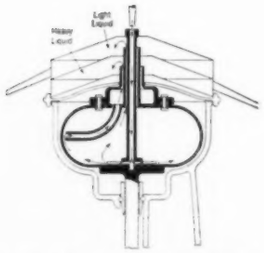
The use of centrifugal purifiers to keep Diesel lubricating oil free from water, abrasives and heavy carbon, dates back to the closing days of World War I. The oil, of course, after purification has remained dark in color due to colloidal carbon, but this colloidal carbon did not adversely affect lubrication as long as the concentration of particles did not get too high.

Recently, however, there has been a strong desire on the part of Diesel engine operators to obtain visibly clean oil. This has led to the use of various types of filters, either with centrifugal purifiers or alone. The De Laval Separator Company conducted several experimental installation tests working with various combinations of its own purifier and various types of filters. The results, in a Diesel-electric plant, a pipe line station and a marine installation, were uniformly good. The oils, mainly straight mineral, and the engines were kept visibly clean. The time between overhauls was extended and the condition of the bearings and rings remained good. The purifier bowl only had to be cleaned one-third as often as formerly and the life of the filter cartridges was extended. Moreover, plugging of the filter cartridges due to water in the oil was eliminated.

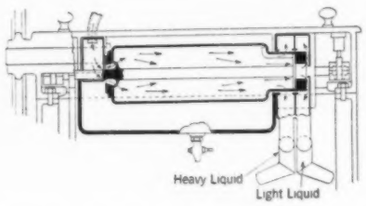
As a result of these experiments, The De Laval Separator Company built the unit now known as the De Laval "Puri-Filter" which combines the De Laval "Uni-Matic" Oil Purifier and the Fram "Filcron" Filters.

The success of the De Laval "Puri-Filter" since it was introduced has borne out the results of those early first tests.

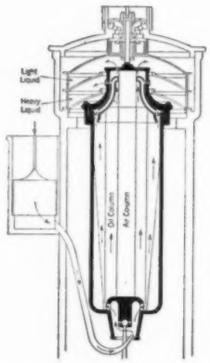
Most of the detergent oils currently recommended for high-speed Diesel lubrication cannot be filtered visibly clean without using activated earth or other absorbent filtering media, which would remove the detergent additives.



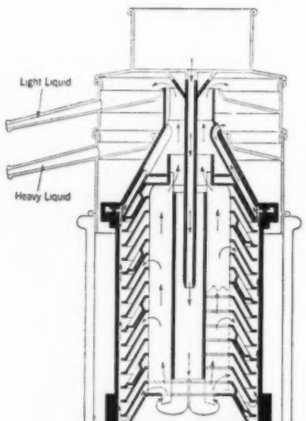
The first De Laval Bowl, 1878—the "granddaddy" of them all.



Horizontal tubular bowl invented by Dr. De Laval in 1886.



Vertical tubular bowl, invented by Dr. De Laval in 1889.



First disc bowl, patented by De Laval in 1890.

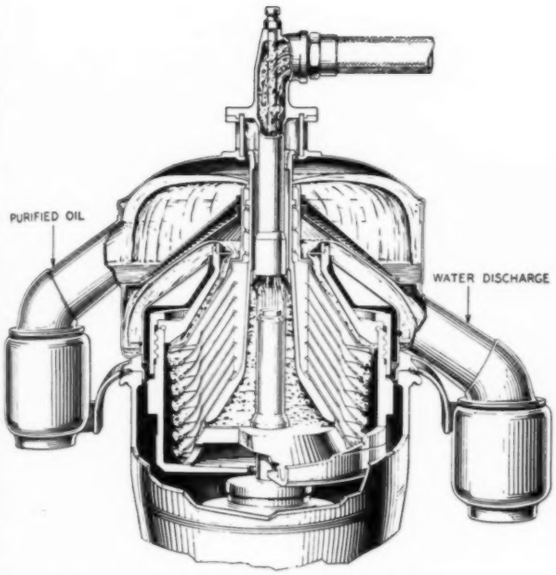
Therefore, Diesel engineers are back to lubricating their engines with dark colored oils. The carbon particles which the detergents keep in suspension in the oil by preventing agglomeration are so small, usually less than a micron, that they are not harmful. If the amount of carbon particles in the oil is allowed to build up too high and the detergent additives lose their effectiveness, trouble may be expected.

It is desirable to keep down the concentration by continual removal since there are limits to the dirt-carrying capacity of detergent oils, and the break may be sudden. The detergents will also keep metal and abrasive particles in suspension, and these definitely should be continuously removed.

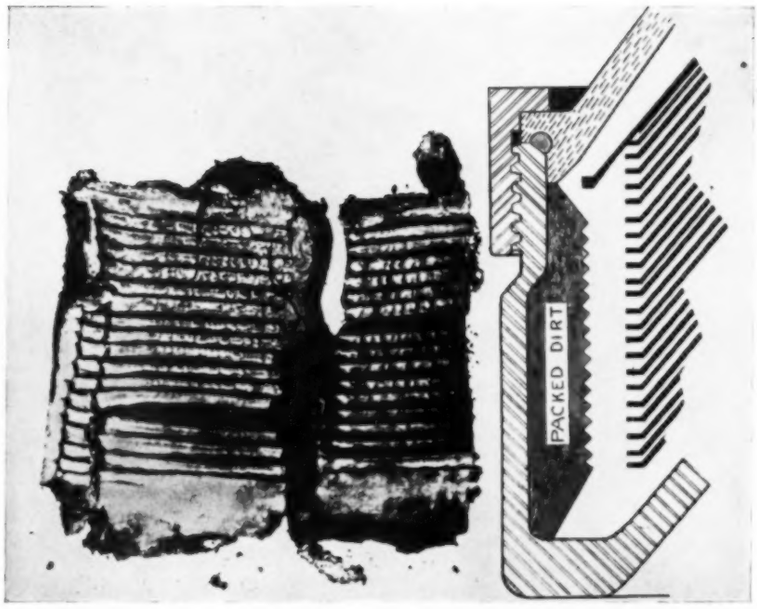
A centrifugal oil purifier on either detergent or mineral oils removes the particles of metal, silica and carbon which are large enough to be abrasive, or to bridge the oil film in a bearing and, of course, it removes any water. The combination of the De Laval Centrifugal Purifier and the Fram Filters keeps the concentration of carbon particles in suspension at a minimum.

When an operator changes from non-detergent to detergent oil, he recognizes that the detergent may pick up sediment from the engine parts and cause clogging or wear unless an effective means is used for continuously removing the abrasive material and larger carbon particles which are loosened and picked up by the oil stream. In some cases, the removal of carbon and gum from the rings and pistons makes them sloppy and increases fuel dilution and blow-by. Proper purification of the oil at such a time can prevent real trouble.

Down at South River, N. J., at the municipal power station, another advantage of the De Laval "Puri-Filter" recently came to light. At the time that the crank case inspection was made, the men emerged from the inspection practically clean. Since engine crank case inspection is traditionally a messy operation, unpopular with operating personnel, the use of the De Laval "Puri-Filter" in this instance at least made a distinctly favorable impression on the operating crew. As a matter of fact, another cleaning operation is facilitated by the use of the combination centrifuge and filter, i.e., the cleaning of the bowl of the purifier



The De Laval disc bowl of today. Dirty oil enters at the top, is divided into thin layers for more effective purification, and discharges clean and dry from top cover.



This photograph shows how dirt packs into sediment pockets of disc type bowl, leaving space between discs free for maximum purification effect.

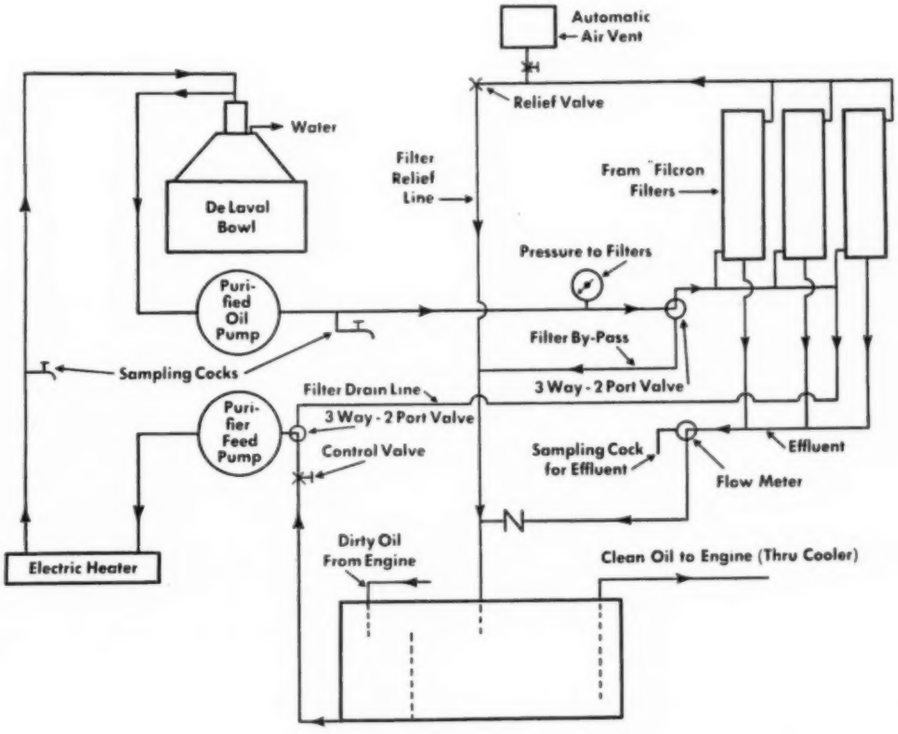
itself. Experience at South River and West Burke, Vermont, has shown that the combination can be operated for unusually long periods without bowl cleaning or cartridge replacement.

The need for centrifuging heavy fuel oils, with the resultant saving in engine wear and improved engine operation, has long been recognized, particularly in commercial marine practice. Ships have to take whatever fuel is available in a port and the engines must be kept running with a minimum of wear and damage. Stories of reducing liner wear by two thirds, due to centrifuging the fuel, are common. Fortunately, most Diesel plants in this country can get and use light Diesel fuels.

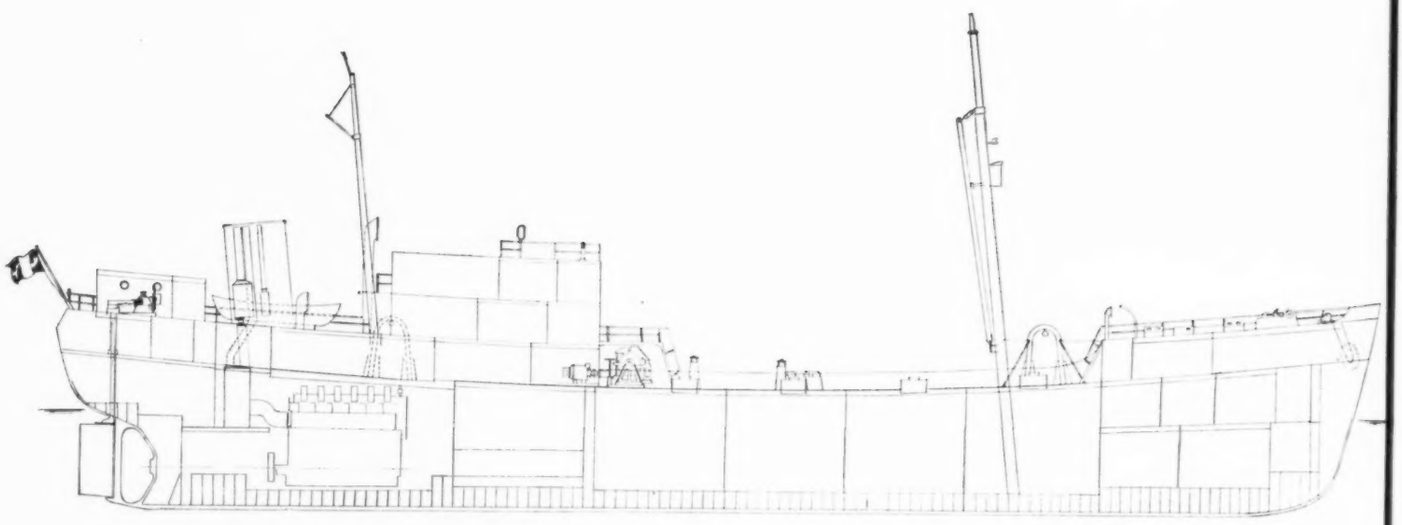
The burning of crude oil from the pipelines in pumping station Diesel engines, made it necessary to develop a means for centrifugally removing and continuously discharging the considerable amount of wax that must be removed from these oils. The "Uni-Matic" Purifier is well adapted to continuously discharging wax and now many pipe line stations are using these purifiers on crude oil.

Even light distillates, which are clean when they leave the refinery, pick up surprising amounts of abrasive solids and sometimes water during transit and storage. In one installation for fueling Diesel locomotives, the centrifugal purifier has been removing seven cubic inches of abrasive material, mainly cinders and silica, per thousand gallons of fuel oil.

***Piping diagram** for De Laval-Fram puri-filter shows complete piping layout as well as pumps, valves, heater, filters and centrifuge.*



DIESEL TRAWLERS FOR FRANCE



Inboard profile view of 68-meter Diesel trawler being built at Bath Iron Works.

BATH, Maine, is a busy little city, but busier still these days is the Bath Iron Works which is turning out ships almost as fast as it did in wartime. There is an air of urgency about the work for ships are being built which are desperately needed abroad. With the close of the war, the French fishing industry tallied its losses and found that its fleets were almost non-existent. Many of the finest ships had been turned over to the allies, others had been seized by the Germans and the result was that France was stripped of the means of carrying on one of her vital industries.

The upshot of the situation was a building program in America with American aid. 32 trawlers are being built at Bath. The first keels were laid in November last year and the first launchings took place in May when two of the 42-meter class slipped down the ways. Of the 32 trawlers, 20 are 32 meters long, 6 are 42 meters, and the remaining six are 68 meters. Three more were launched in June and the remaining 27 will be slipping off the ways as regularly as clockwork from now on.

As can be seen from the drawing of the 68 meter ship above, the general arrangement is similar to the designs utilized in our own trawlers. The fish holds, four in number, are located forward with the engine room aft. Both the 32 and the 42 meter ships follow the same general arrangement. They are all steel construction, welded and riveted hulls. The machinery as planned for these ships includes the following: The 68 meter trawlers will have a Burmeister and Wain 1070 bhp., 6 cylinder Diesel turning at 165 rpm. Auxiliary and winch power will be furnished by two B. & W. Diesels developing 250 bhp. apiece A 40 kw. B. and W. Diesel generating set will supply emergency power. Pumps will be furnished by De Laval and Worthington. Maxim silencers will be installed on the Diesels. Two De Laval purifiers will handle the lubricating and fuel oil, while the Condenser Service and Engineering Co. will supply the oil cooler. A combination Diesel exhaust and oil fired boiler by the Hodge Boiler Works will supply steam. A 450 psi. hand air compressor by Bolinders is planned.

The 42-meter class trawlers will be powered with a 750 hp., 200 rpm. Baldwin Diesel. A 6 cylinder Hendy Diesel will drive the trawl winch generator and a General Motors 2 cylinder Diesel generating set will furnish emergency power needs. The lube oil service and transfer pumps are "IMO's" by De Laval. A Gardner Denver air compressor will furnish starting air for the main and auxiliary Diesels. Worthington will supply the bilge and ballast pump and also the general service pump. Ross coolers handle lube oil and fuel oil cooling. A De Laval Uni-Matic purifier is planned for lube oil conditioning. The general dimensions of the 42 meter trawlers are: length overall—152 ft. 5 in.; Length at waterline—144 ft. 4½ inches; Molded beam—27 ft. 1 in.; Molded depth—15 ft. 5 inch. and Mean draft—13 ft. 2⅝ in.

The 32 meter boats are trim fishermen. In all twenty of these craft will be built. They all will be powered with Burmeister and Wain, 450 bhp. 6 cylinder, direct reversible Diesels turning at 185 rpm. For auxiliary and winch power, a 150 bhp. General Motors Diesel is to be installed. A 10 kw. General Motors Diesel generating set will act as standby emergency power. De Laval "IMO" pumps will handle the lube and fuel oil service and transfer pumps. Worthington water pumps will be installed for general service and bilge and ballast. A Maxim silencer will be installed on the main engine exhaust. An Ingersoll-Rand compressor, 5x2½x4 in., 450 psi. will supply starting air. A Bolinders hand air compressor will be installed for emergency use. A lube oil cooler by Condenser Service and Engineering Company rated at 69 gpm. for a 140-115°F. temperature drop.

Conducted by R. L. GREGORY*

UNIT INSTALLATION AND ITS EFFECT ON OPERATING PROBLEMS—PART 5

WITH the completion of the installation of the crosshead guides, the next step in erection was that of installing the crossheads, connecting rods and compression shims. Care must be taken to keep the proper clearances and to install the crossheads without marring the babbitt faces of the crosshead guides. These guides were all inspected for burrs and then well lubricated.

The crossheads themselves were inspected and well cleaned, and the oil passages thoroughly cleaned out, the faces where the spill pipes were connected were cleaned and inspected for burrs. In the installation of each of these units, they were picked up individually with the crane, spotted over their respective guides, each crosshead guide and crosshead having an identification number, and slowly lowered into position. In so doing great care was exercised to see that the crosshead slipped into its respective guide easily without binding.

As the crosshead and connecting rod were lowered onto the connecting rod bearing, the compression shims were placed on the top of the bearing with that particular bearing in top position. With the shims in position the connecting rod and crosshead were lowered on two guide pins to hold them in proper position. When in place, two connecting rod bolts were installed, the two guide pins removed and the other two connecting rod bolts installed and then all bolts tightened in position. One thing was noted, that during the installation of these parts, all dust and foreign particles were kept away from the parts being installed. It is very easy in working around a unit of this type to be careless and kick or drop something which will later cause trouble.

Figure 1 shows a section of three of the crossheads and connecting rods installed. On the center one, you may note that the spill pipe which carries the cooling oil back into the crankcase has been installed. With this operation completed and the nine crossheads and connecting rods in place, clearances checked and connecting rod bolts securely tightened, the next step was the installation of the cylinder blocks.

Each cylinder block was given a thorough cleaning and inspection. All contact surfaces were cleaned and inspected for burrs or blemishes caused in handling or transportation, if any were found they were removed. Before installation of the cylinder blocks, the tops of the "A" frames were inspected and checked for level. Figure 2 shows the installation of number 9 cylinder block. The contact surface between the top of the "A" frame and the bottom of the cylinder block were given a thick coating of glyptal which was allowed to dry. Then a

* *Chief Engineer, Municipal Water and Light Plant, Hillsdale, Michigan.*

Figure 1. Three crossheads and connecting rods installed on new Nordberg Diesel.

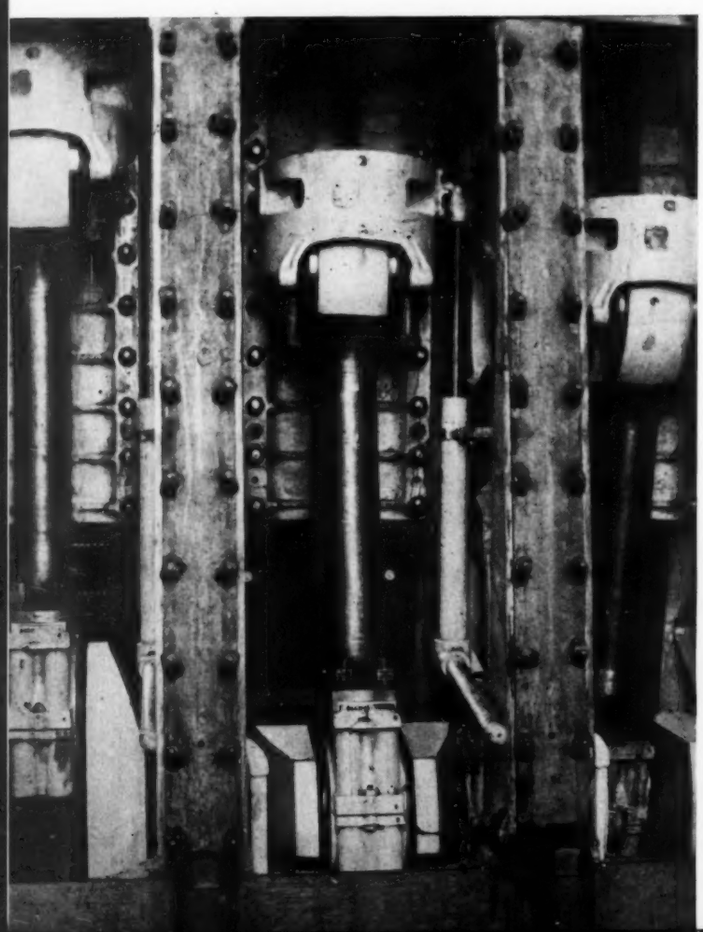


Figure 2. Installation of number 9 cylinder block. Joint between cylinder block A-frame sealed with glyptal.

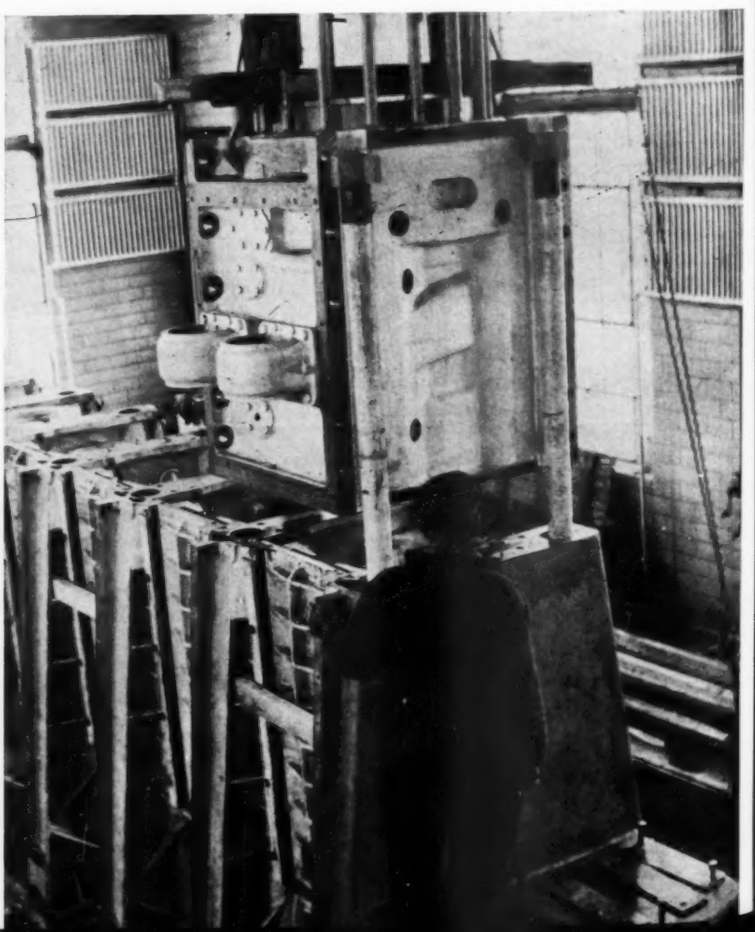


Figure 3. Several cylinder blocks now installed and bolted in position. Tie rods are being lowered into position.

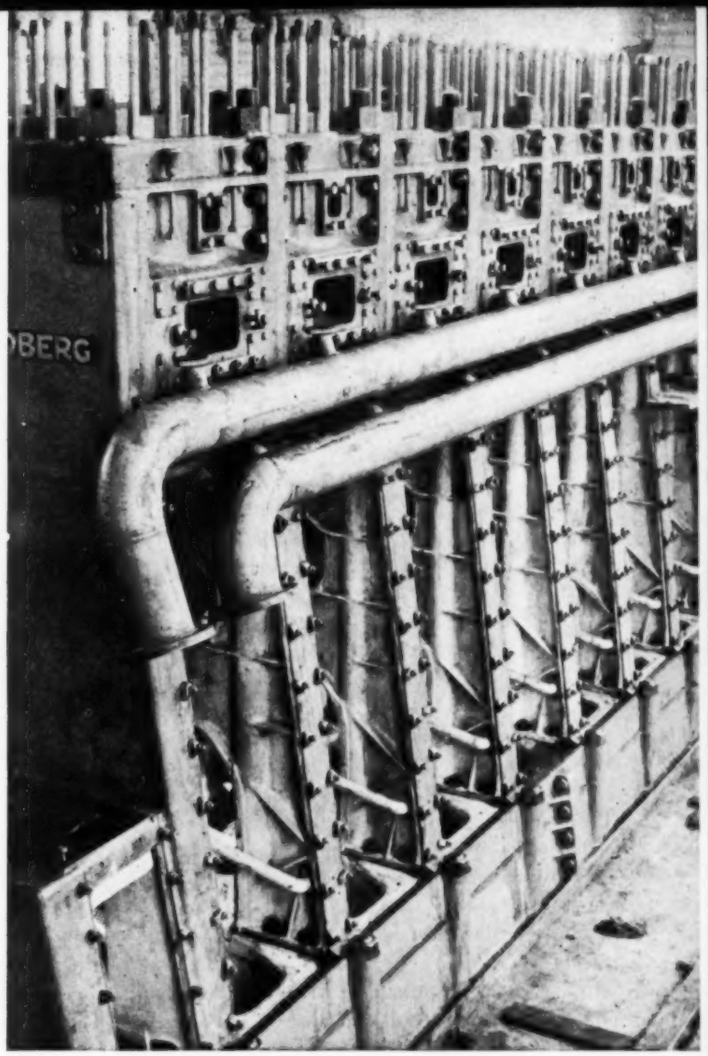


Figure 4. All nine cylinder blocks are now installed. Cooling water header and drain line now being placed in position.

second coating was applied and while still wet, the cylinder block was lowered into position, doweled and bolted firmly down. You will note in Figure 3 the two tie rods which had previously been inserted. These tie rods pass down through the cylinder block, "A" frame and through the bed plate and after all cylinder blocks are in position, with all tie bolts inserted the large nuts on the top of the tie rods are tightened with a special hydraulic jack, so that the tension is the same on all rods.

Figure 3 shows several cylinder blocks installed, bolted down in position and bolted together. It also shows the method of handling and lowering the tie rods into position. All contact joints were treated with two coats of glyptal as previously mentioned. This made them leakproof and stopped any seepage.

Figure 4 shows all nine cylinder blocks in position and bolted down and shows the next step in erection, that of installing the cooling water header and drain line. These run the full length of the unit, each cylinder having its individual takeoff from the header and also its individual return line to the drain. The connections for these are easily seen on the top of each pipe, they being couplings welded right into the pipes. In this photo you can also note the exhaust port from each cylinder, which is the rectangular opening on each cylinder just above the cooling water header. This system of cooling is of the closed type, the cooling agent being pumped into the heads, back out through the drain line, then through the soft water cooler and again picked up by the pump to be recirculated. The system has a large expansion tank, located two floors above the operating floor, which expansion tank holds enough water to maintain a full system of cooling agent at all times.

The next step in erection, that of installing hte 30 inch exhaust line. The header is bolted onto the various exhaust openings of the cylinders. Since this header runs the full length of the unit, it was necessary to provide some means for expansion and contraction. This was taken care of by the installation of an expansion joint, known as a "Zallea Flexible Coupling." This was installed between the front and rear sections of the exhaust manifold, it being in two sections.

In installing the exhaust header care must be taken that all joints are tight, gaskets in place and that there is absolutely no binding when the various joints are bolted together. This exhaust header turns downward through the operating floor where another Zallea flexible coupling is installed, thence runs along under the floor out into the blower room and turns upward and is connected to the silencer which is mounted on the blower room roof, more of which will be discussed in a later article.

The up and down expansion is taken care of by means of a large bracket bolted on the foundation and equipped with a heavy spring. It is also supported in a horizontal position below the operating floor, by means of a heavy upright steel column, equipped with a "V" shaped roller to allow for come and go during operation.

DYNAMIC BALANCING FOR ROTATIVE EQ

By H. E. HERMANN*

THE "Train of Tomorrow" which has recently made railroad history includes the latest in design in its every feature. So it is not surprising to note that besides "Vista Domes" and independent Diesel units for each car, the train rolls on dynamically balanced wheels. Much of the vibration and noise encountered in train travel can be attributed to unbalanced wheels.

As little as one pound of unbalance in a car wheel multiplies to 447.2 lbs. when the train is traveling at 100 mph. This force is detrimental to the life of the equipment and to the comfort of the passengers. The action of the unbalanced force is such as to cause the wheels to move horizontally, forward and backward while the train is in motion. This motion is taken up by the bearings and by the clearance between the bearing housing and the truck. However some of this motion is carried into the car itself causing vibration and noise.

The Bear Manufacturing Company statically and dynamically balanced these 18 sets of car wheels for the "Train of Tomorrow." For a better understanding of the process an explanation of static and dynamic balancing should be made here. Static balancing is simply a weighing process with the body at rest. Centrifugal and dynamic forces are not considered. Static balance is accomplished by adding material at the light section or by removing material at the heavy section so that any part of the circumference will rest over the axis. Static balance determines the amount and angular plane in which the unbalance is located. Corrections are made irrespective of the location along the axis of rotation. Dynamic balancing, on the other hand, is the process of rotating a body at sufficient speed so that centrifugal forces due to an unbalanced distribution of weight may be located and measured. The amount and position of dynamic unbalance may only be determined by revolving the body on a balancing machine which will indicate the disturbing centrifugal force or force couple. Corrections are made respective of the locations along the axis of rotation.

The 3200 lb. car wheels for the "Train of Tomorrow" where balanced on a Bear balancing machine having a capacity of 4,000 pounds and a bed length of 11 feet 6 inches. It was powered by a 7½ hp. four-speed motor. The balancing was done at 325 rpm. The final balance testing was done at 620 rpm. which is approximately 66 miles per hour in terms of car speed. The method used for removing the material consisted of air grinders held by hand with a helper rotating the wheel back and forth. This operation was performed with the wheel in the balancing machine so that a periodic check could be made of the balance. Altogether, there were 35.9 lbs. of material removed from the 18 sets of wheels.

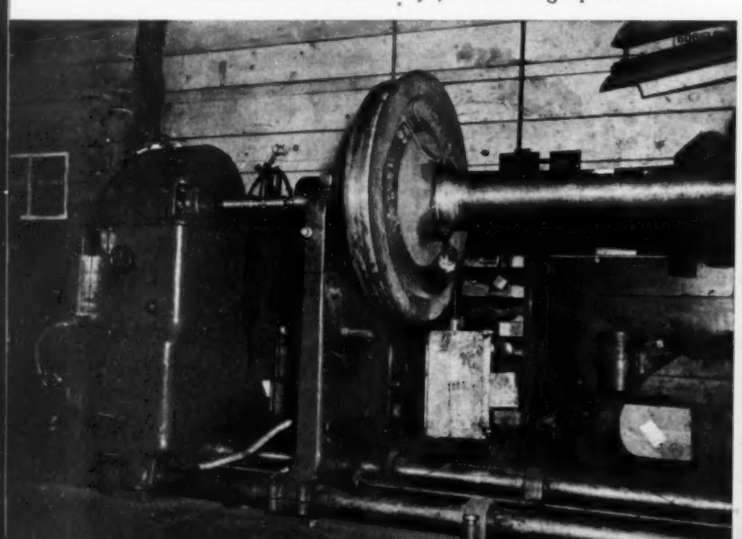
Experience in balancing car wheels has shown that wheels even completely machined have a certain amount of unbalance with the cumulative effect of causing vibration in railroad cars. In addition to improving the riding quality of the car, balancing lengthens the life of the rolling equipment. It makes for better bearing life as well as allowing more miles traveled per unit of wheel wear. It reduces the eccentricity of the wheels. It reduces side motion of the car which is caused by dynamic unbalance. Dynamic unbalance on a set of car wheels causes them to hunt and finally synchronize with the sway of the car.

The balancing of car wheels is only one of the uses of balancing machines. They are used extensively to balance all types of rotating equipment. Propellers, fans, rotors for pumps and blowers, all can be balanced accurately. It must be remembered that high rotative speeds greatly increase the destructive forces of unbalance. One ounce of unbalance at a one inch radius on a rotating body amounts to a force of 45 lbs. 10 oz. at 5,000 rpm. Electric motor and generator armatures and high speed centrifuge bowls must be balanced exactly to insure safe operation.

The application of balancing machinery to the Diesel industry is an interesting one. Many of the accessories for Diesel operation such as blowers, oil centrifuges, generators, require balancing, but one of the most important balancing operations is that of the crankshaft and camshafts of Diesel engines themselves. The picture below shows a crankshaft balancing operation underway at the Climax Industries using the same type machine as was used for the wheel balancing operation. The crankshaft is placed in the machine and set level by means of adjustable bearings. The machine is then put in operation and the shaft quickly reaches its balancing speed. It will be noted that the number 3 appears in an aperture of the drive casing of the machine pictured below. This number is one of a series mounted on a drum

* *Works Manager, Bear Manufacturing Co.*

View of Bear Balancing Machine set up with pair of "Train of Tomorrow's" wheels ready for balancing operation.



Balancing Diesel engine crankshaft at the Climax Industries plant. Crankshaft is balanced for normal engine speed.

EQUIPMENT

connected integrally with the drive shaft which indicate the angular position of unbalance. A smaller disc or spark dial numbered the same as the larger disc is used to correlate the two when the balancing machine is operating. When the crank has reached speed, the operator adjusts the left micrometer dial (located near top of left hand pedestal) until flashes show on the spark dial at one of the numbers thereon. Then the right hand micrometer dial is adjusted until flashes show on the spark dial.

If the two micrometer dials show the same reading on the spark dial, it has been established that the unbalance is static. If the dials show opposite values (values 180° apart) it is an indication of dynamic unbalance. If the numbers are neither opposite nor the same, it is a combination static and dynamic unbalance condition. Once these facts are determined, the balancing operation is relatively simple. The operator knows where to add or remove weight since the correlation of the numerals on the numbered drum and the spark dial tells him just where the unbalance is. In the case of crankshaft balancing once the type and location of the unbalance is determined, material is removed by grinding on the throws or counterweights.

It must be remembered that a dynamically unbalanced body can be in balance under static conditions, at rest. With dynamic unbalance, the center of gravity may be in the same axial plane, but on opposite sides of the axis of rotation. To correct the dynamic unbalance material must be removed from the heavy spot or added to the light section.

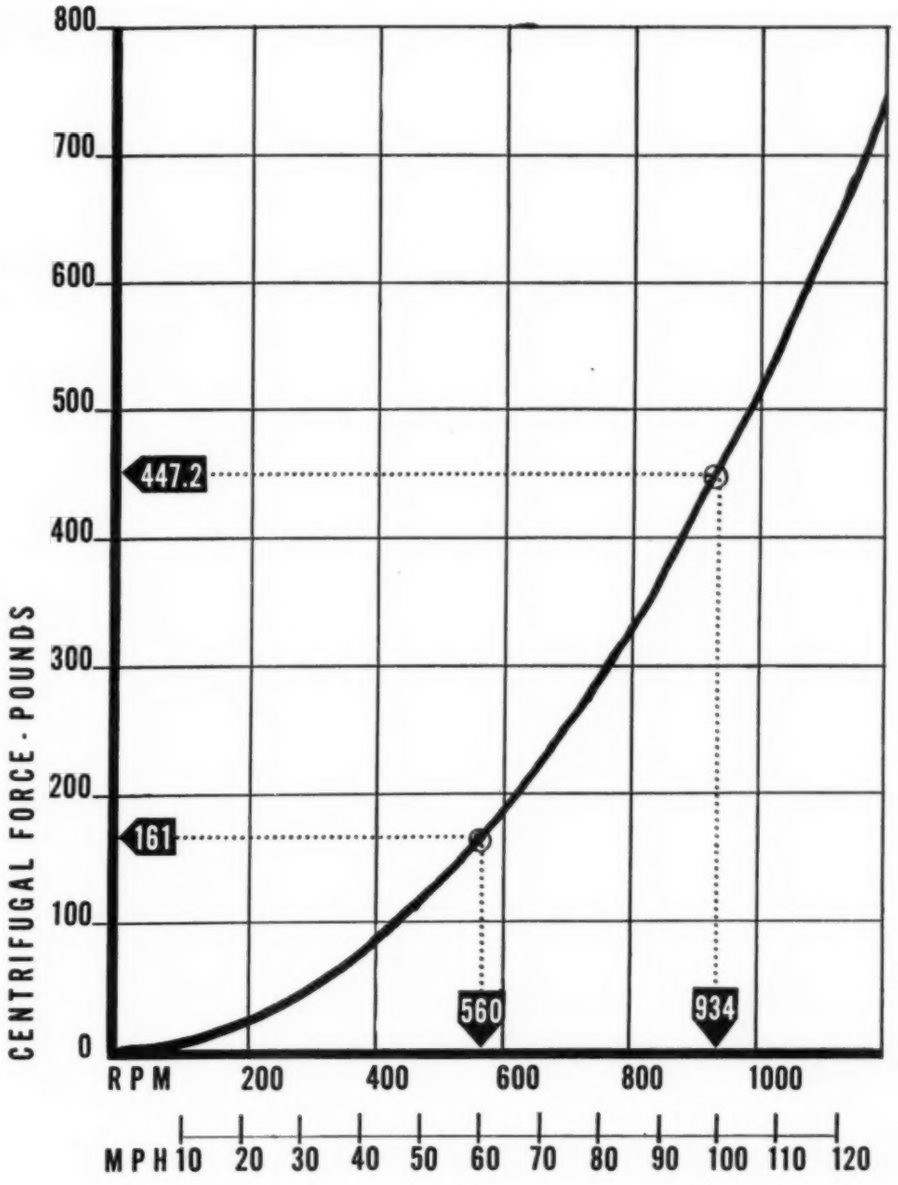
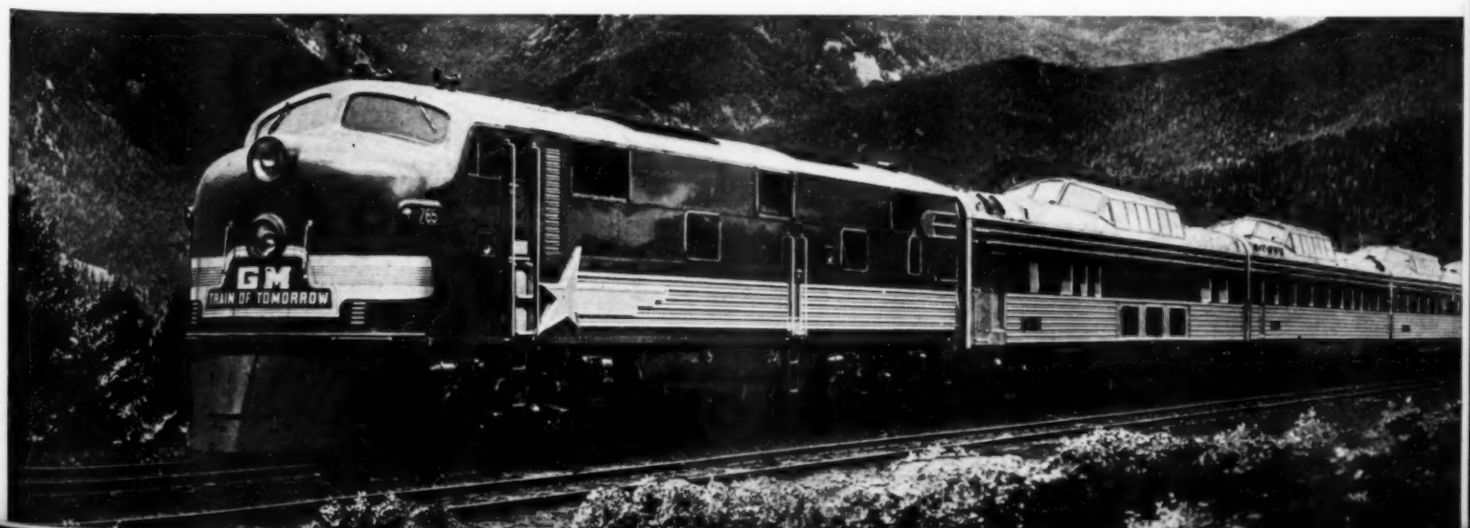


Chart showing the effect of one pound of unbalance in a car wheel acting at 18-inch radius. Note that at 100 mph. one pound of unbalance multiplies to 447.2 pounds.

View of "Train of Tomorrow" Diesel luxury streamliner whose cars all have Dy-Namically Balanced wheels.



D.E.M.A. To Extend Educational Program

A PLAN has been set up to broaden the educational program of Diesel Engine Manufacturers Association to include participation by parts and accessory manufacturers, makers of Diesel fuels and lubricants, and publications specializing in the Diesel field. The project will be discussed at a meeting to be held by the Association, September 12, in Boston.

At the last meeting of DEMA's board of directors, held in Cleveland, the directors analyzed the Association's experiences in working with schools of various levels, and the need for better training in Diesel engineering. They concluded that many of the problems in which the schools are interested are related to the products made by manufacturers of Diesel engine parts, accessories, fuels and lubricants.

In view of these facts the board has decided to invite such manufacturers to take part in an educational program which will extend over the next five years. According to present plans, members of the auxiliary group will meet at intervals with the Diesel engine manufacturers, to review the progress made on the cooperative educational program, and to propose any revisions in it that may seem necessary.

At the Boston meeting, to be held at the Copley Plaza Hotel, the board of directors and the members of DEMA will meet with the representatives of firms that have expressed an interest in participating in the educational program. Basic organization plans will be set up for the next five years because the program will require time and continuity of effort to achieve its ends.

E. J. Schwanhausser, vice president of Worthington Pump and Machinery Corp. and president of Diesel Engine Manufacturers Association, will preside at the organization meeting, which is scheduled for 10:00 a.m. Gordon Lefebvre, president of The Cooper-Bessemer Corp. and chairman of the Association's educational committee, will outline the progress the committee has made in the past three years. Harvey T. Hill, executive director of the Association, will tell of the opportunities for further educational service over the next five years.

Representatives of the parts and accessory makers who are present will be invited to remain for the Association's marine conference, which is to take place in the afternoon.

BILLIONS FOR REFINERY EXPANSION

Railroad officials and other users and potential users of Diesel engines frequently inquire as to the outlook for fuel supply. Clearly enough most of the questions originate in the Middle West where spot shortages exist (temporarily). Answers to these anxieties are given in an article prepared by Editor E. W. Mayo for the current Annual Refinery issue of WORLD PETROLEUM and a statement by Gordon Lefebvre, President of The Cooper-Bessemer Corporation which we are glad to publish below.—The Editor.

AT midyear 1947 the refinery industry faces a situation practically without precedent, one in which the demand for its products is crowding its capacity to supply. This condition has arisen despite a great expansion of plant facilities since the close of the war. It is not one for which the oil industry can be held responsible, since the progress of refinery construction has been limited only by the ability to obtain materials. Yet it has progressed to a point that has caused concern to manufacturing and marketing organizations which in some sections have had to resort temporarily to allocation of supplies to their distributors. It has led to anxious inquiries in official quarters and to protestations from heads of the armed forces. It has likewise troubled the thoughts of business and financial leaders who realize the close dependence of industrial activity as a whole upon adequate supplies of petroleum products.

In the United States, as has been authoritatively pointed out and as current statistics confirm, there is no actual scarcity of oil and no prospect of any in the foreseeable future. With total demand sharply up by nearly a million barrels daily, crude production has been raised to 5,100,000 barrels, natural gasoline and condensate provide over 350,000 barrels and imports run to 480,000 barrels. This supply of more than 5,900,000 barrels daily maintains a safe if not too ample margin above a combined domestic and export demand that has touched a high point of 5,840,000 barrels and averages about 5,700,000. To process the crude production, the country, according to a recent survey, possesses available refining capacity of 5,600,000 barrels daily. This capacity it may be mentioned is growing from month to month as new installations in existing plants come into operation. With hundreds of refineries scattered throughout the country, 100 per cent operation is not to be attained or expected. Plants occasionally close down for overhaul or repairs. Sometimes they are closed by accidents or strikes. Some 15,000,000 barrels of refining capacity has been lost by work stoppage during the first half of 1947.

While domestic production, imports and refining capacity are all capable of being raised to maintain a statistical balance, spot shortages have developed at various times and places from other causes. Steel mills have not been able to fabricate pipe fast enough for the building of crude lines to move all new production to refining centers or products lines to markets where demand has risen most rapidly. Again as in wartime, it has been necessary to resort to more expansive tank car transportation. Inability of refiners outside the United States to obtain needed equipment has delayed reconstruction of their plants and has maintained a

strong export demand for products which it has not been possible to meet in full because of the tight internal situation. The bearing of this development was brought out recently in the report to the United States Department of the Interior by a special committee of the National Petroleum Council which pointed out that the export of materials and equipment for refinery construction would help materially to relieve pressure upon the American market.

Fundamentally the important aspect of the present situation is that the world has entered upon a new and unprecedented era of expansion in the demand for petroleum products. That the refining industry has been prompt to recognize this upsurge and to take steps to cope with it is evidenced by the survey of new construction and plant expansion that appears on other pages of the Annual Refinery issue of WORLD PETROLEUM. In 1946, when the industry and its suppliers had scarcely had time to catch their breath after the hectic wartime expansion, expenditures authorized for added facilities were greater than in any prewar year. In 1947 the capital investment undertaken has been nearly doubled. While it is possible in a period of rising costs to determine exactly the expenditures required to translate into completed structures the plans already approved, the estimates of a dozen of the larger international companies show that the amount will run to thousands of millions of dollars for the next several years.

To feed refineries with a combined daily capacity of 10,000,000 barrels which will clearly be reached by 1950 will require, of course, very large additions to production and to transportation and marketing facilities. In a recent statement by President William R. Boyd, Jr., of the American Petroleum Institute, it was estimated that expenditures for these purposes by American companies alone during the two years 1947-48 would aggregate four billion dollars, representing more than 22 per cent of the capital investment of about eighteen billion dollars in the oil industry, now second largest in the country.

Vast as are the demands upon the world's oil industry, these demands are being met and will continue to be met with promptness and efficiency as long as the oil industry is permitted to exercise the freedom of initiative and enterprise that has built it to its present inspiring dimensions. And since there is no other industry in which the obsolescence of methods and equipment is so rapid due to the progress of

. . . . *And now please turn to page 72* . . . .

Billions— *Continued from page 71*
research and invention, there is little likelihood of any slackening in the rate of replacement and construction for many years to come.

Predicts Fuel Shortages Will Increase Diesel Use

Increased usage of Diesel engines, due to the growing shortage in America of all types of engine fuel, is predicted by Gordon Lefebvre, president and general manager of The Cooper-Bessemer Corporation.

Mr. Lefebvre bases his prediction on the fact that the Diesel engine which has long offered the greatest thermal efficiency of any type of prime mover, has by reason of recent improvements been made even more efficient and therefore more economical.

At a recent meeting of members of the Diesel Engine Manufacturers Association in Chicago, Mr. Lefebvre urged the industry to take cognizance of the fuel situation and to redouble its efforts to make American industry conscious of the many new functions which the Diesel is capable of accomplishing at greater fuel savings than have ever before been possible.

Recent refinements in the gas-Diesel engine, for example, have lowered the fuel costs of a municipal power generating plant in Cherokee, Oklahoma, by a margin considered to be impossible even by Diesel engineers a short time ago.

Evidence of the efficiency and economy of Diesels in railroad service is contained in the fact that in some parts of the country, it is replacing the steam-powered locomotive almost 100 per cent and is making tremendous inroads even in the coal-producing sections.

Diesel usage by industry generally has gained materially in recent years, and particularly in those areas which have been hardest hit by periodic coal shortages induced by labor-management dissension.

"It may seem incongruous to predict that an engine which burns fuel oil will find greater use in the midst of an oil shortage which is already in evidence in some sections of the nation," Mr. Lefebvre declared, "yet when the whole American power picture is analyzed, it should be quite apparent that when other types of fuel are equally short in supply, the power that can be most efficiently produced is the one that will be most generally adopted."

The Diesel industry, he points out, has had its most progressive period of development since the advent of World War II, when hundreds of new uses have been found for Diesel engines, and engineers in the industry have been quick to realize its future possibilities through improvements and refinements. Cooper-Bessemer engineers, he added, are now engaged in several experimental projects which may still further raise the thermal efficiency of both Diesel and natural gas engines to a point never before dreamed possible.

Sparks Named Buda District Representative

THE Buda Company has announced that Fred W. Sparks has been appointed as district representative to handle the Ohio territory for the manufacturer's engine division.

Mr. Sparks has had considerable experience in engine and equipment business. He was formerly with the Euclid Road Machinery Co., at Cleveland, Ohio as one of their field representatives. Before that he was with The Cummins Engine Co., at Columbus, Indiana for 7 years as Ohio regional sales manager and Central States manufacturer's sales manager. He has also had experience with the Chambers Corporation and with the Auburn Auto Co.

Texaco Lubricates Record Tow

AFTER a record making 13,000 miles voyage, the Moran Towing and Transportation Company's tug *Watch Hill* arrived at Banka Island, Netherland East Indies, on June 8th, with the huge 4,000 ton tin dredge *Stuyvesant*.

The voyage, which started from Tampa, Fla., on March 11, stopped only twice, at the Panama Canal and at Kwajalein, and consumed 89 days, was made without a single main engine failure.

A second similar tow, the tug *Moose Peak* and the tin dredge *Roosevelt* put to sea from Tampa on May 9th and is expected to arrive at Banka in August.

The *Watch Hill* and *Moose Peak*, both 1,117 gross tons and powered with Diesel engines developing 2,250 horsepower, and with special equipment which makes them the most powerful tugs in the merchant marine, used Texaco fuels and lubricants entirely.

Ralph V. Davies Succeeds George J. Stanley At Alcoa

RALPH V. DAVIES, Robert B. McKee, and Donovan Wilmot, assistant general sales managers for Aluminum Company of America, have been promoted to vice presidents of the company, it was announced recently. Mr. Davies will also become general sales manager for Alcoa, succeeding George J. Stanley, vice president and general sales manager whose retirement as of July 1, 1947, was announced recently.

Mr. Davies came with Aluminum Company of America in 1919 as a metallurgist at the company's New Kensington, Pa., works. In 1922 he was transferred to the Rochester, N. Y., sales office, and later to Buffalo. He was shifted to Alcoa's Washington, D. C., sales office in 1925, became manager in 1928, and was made manager of the New York sales office in 1930. In 1943 he was made product manager for ingot sales, with headquarters in Pittsburgh, and in 1944 became assistant general sales manager in charge of the company's sales engineering and sales development activities.

All three of Alcoa's new vice presidents are members of the company's "25-Year-Club," with over a quarter-century of service apiece.

Order Your Copy of the 1947 DIESEL ENGINE CATALOG now for shipment early in August. Thoroughly revised—more complete — indispensable. Convenient order coupon on Page 95 this issue. Mail it today.

ENGINEERING SOCIETIES MEETINGS SCHEDULED

A.S.M.E. 1947 Meetings

Fall Meeting	Salt Lake City	September 1-4
I.L.R.D.		
2nd National Conference	Chicago	September 8-9
Petroleum Mechanical Engineering		
1947 Conference	Houston	October 6-8
Fuel and Coal Division		
10th Joint Conference	Cincinnati	October 20-22
Annual Meeting	Atlantic City	December 1-5

S.A.E. National Meetings

West Coast Transportation & Maintenance	Los Angeles	August 21-22
Tractor Meeting	Milwaukee	September 17-18
Aeronautic		
Fall Meeting & Aircraft Engine Display	Los Angeles	October 2-4
Production Meeting	Cleveland	October 20-21
Fuels and Lubricants	Tulsa	November 6-7
Air Transport Engineering	Kansas City	December 1-3
Annual Meeting and Engineering Display	Detroit	January 12-16

Governor Conference Accounted A Success

THE Woodward Governor Company conducted its Eleventh Prime Mover Control Conference (Governor School) at its plant in Rockford, Illinois, from June 16th to June 21st.

The school opened with the presentation of a paper on the "Fundamentals of Speed Governing of Prime Movers" by G. Forrest Drake, Woodward Chief Engineer; and continued with four days of theoretical and practical instruction in all types of prime mover governors. In attendance at the school were engineers, executives, operators and field service men representing users and manufacturers of Diesel and other internal combustion and water prime movers.

The conference was held in one of the most progressively modern plants in the country. All were given an opportunity to see the windowless, air conditioned factory, designed and equipped for maintaining the best of working conditions and maximum worker efficiency.

In addition to the business sessions Woodward was the most gracious of hosts during the evenings. The conference was both constructive and pleasant.

Boyer on B.T.U.—*Con't from page 45*

trates in a general way the condition existing in many plants today.

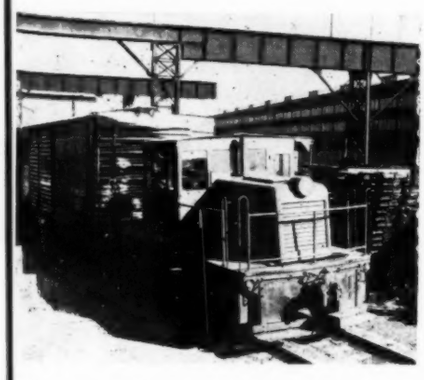
Consider the situation with performance data guaranteed and tested, and operation predicated on the basis of Btu. The manufacturer's guarantee would now be as follows:

Full load 7,160 Btu. per bhp.-hr., high-heat value
¾ load . 7,160 Btu. per bhp.-hr., high-heat value
½ load . 7,740 Btu. per bhp.-hr., high-heat-value

During test the full-load heat-consumption rate would have been 0.378 × 18,800 or 7,100 Btu. per bhp.-hr., a value less than the guaranteed value. Furthermore, as fuels of different heating values were received, performance data for the engine could be expressed on a truly comparative basis.

It can be argued, and rightly, that custom has required us to think of engine performance in terms of pounds of fuel per unit of output so long that we can't think any other way. Perhaps that is true. But isn't there going to be a lot of fun for those of us chained to past habit when we get to juggling 17 years of performance records based on a reference heating value of 19,000 Btu. per pound of fuel, and tomorrow's performance records based on 19,350 Btu. per pound of fuel? Let us hope that someone doesn't get too badly burned on those ancient and modern high-heat value figures.

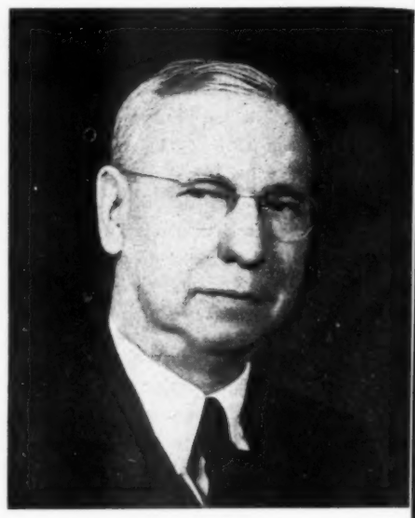
G-E 45-Ton Diesel-Electric Locomotive Speeds Freight Car Production



This General Electric 45 ton, 300 hp. Diesel-electric locomotive, replacing a 90 ton steam engine, is speeding freight car line production for American railroads at the St. Louis plant of the American Car & Foundry Company. Over a period of three years, this 45 ton locomotive has operated an average of 10 hours a day, six days per week; an approximate total of 9,500 operating hours. During this period the locomotive has had an availability for service of more than 95 per cent.

Nordberg Names Telfer Special Representative

NORDBERG Mfg. Company of Milwaukee announces the appointment of A. S. (Joe) Telfer as Special Representative of the Heavy Machinery Division, specializing in Diesel engines for oil pipe line service. He will cover the Texas and Mid-Continent fields, with headquarters at Houston, Texas.



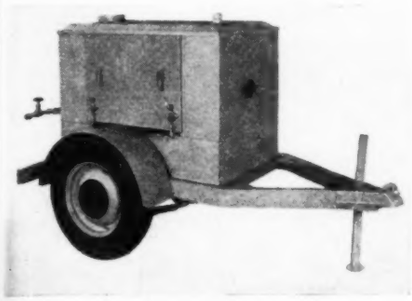
A. S. Telfer

From college Mr. Telfer entered the employ of the Goulds Pumps, Inc. and was engaged in the sale of oil field pumps for a period of about 7 years. For the past 22 years he has been associated with Busch-Sulzer Bros.-Diesel Engine Company with whom he also covered the oil pipe line trade and which company was recently acquired by Nordberg. During his many years of contact with oil pipe lines in the sale of both pumps and engines, he has built a wide acquaintanceship in this field making him exceptionally well qualified as a special pipe line representative of Nordberg.

Bulldozer Bulletin

THE three sizes of straight blade, cable controlled bulldozers manufactured by Caterpillar Tractor Co.—the No. 8S, the No. 7S and the No. 6S—are described and illustrated in detail in a new booklet "Caterpillar Straight Blade Bulldozers." The 12-page booklet records the structural and operational features of the bulldozer units which are designed exclusively for use with the "Caterpillar" Diesel D8, D7 and D6 track-type tractors. The booklet emphasizes, and illustrates with cross-section views, blade, tilting brace and sheave construction. Copies of the booklet may be obtained by writing the Caterpillar Tractor Co., Peoria 8, Ill., requesting Form 10225.

Oakite Steam Cleaning Unit



Oakite unit mounted on trailer chassis.

THE new, improved Oakite-vapor steam cleaning unit, for use in cleaning and paint-stripping a wide variety of industrial equipment and plant facilities, is now available for immediate delivery, according to a recent announcement by Oakite Products, Inc.

The unit, an enclosed-coil type, down-draft flame steam generator, delivers a hot vaporized spray in either wet or dry state under pressures up to 200 lbs. Unit generates sufficient steam-cleaning pressure to operate two steam guns simultaneously.

According to service records, the company reports, the new trailer-mounted steam cleaner has been used for stripping paint from electrical transformers, both pole-type and underground units; degreasing stationary and portable Diesel engines.

The unit is available as a stationary model; mounted on shop-wheel chassis for around-the-plant portability; or mounted on a trailer-type chassis for use at locations away from shop or plant. Complete description of construction, operations and maintenance may be obtained by writing to Oakite Products, Inc., 22D Thames St., New York 6, N. Y.

Harvester Aids Flood Clean-up

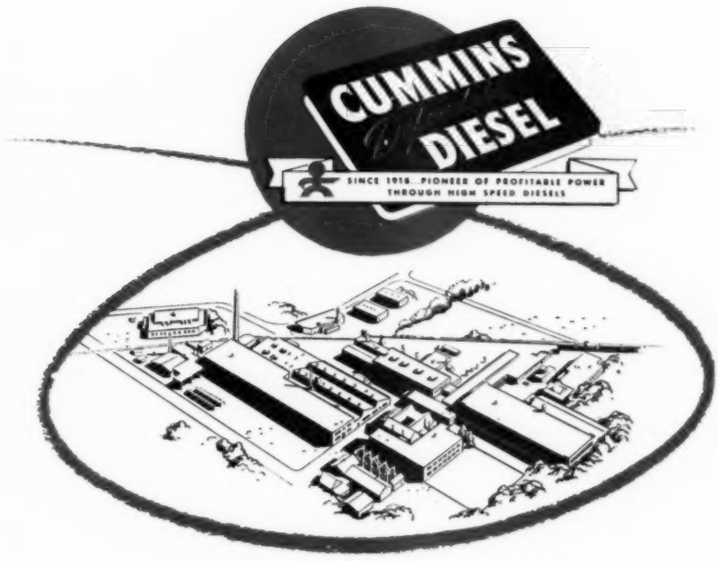
THE International Harvester Company recently announced it was readying nine of its International TD-9 crawler tractors for use in the various inundated areas of the Middle West, according to H. T. Reishus, general manager of the company's industrial power division.

Six bulldozer units will be equipped with Le Tourneau cable carry-all scrapers which will be pulled by each tractor. When the various attachments are mounted the tractors will be shipped to the Chicago, Burlington and Quincy Railroad's Havelock, Nebr., shops, six miles east of Lincoln, where the equipment will be numbered and registered for operation. From the C.B. & Q's shops the tractors will be shipped to various flooded areas in Nebraska, Iowa, Missouri and Illinois, depending on the local conditions.

The heavy industrial crawlers, Reishus stated, will be used for every purpose imaginable. The scrapers, he said, will be used to clean ditches, while the front-end loaders will be used for cleaning out underneath bridges and picking up dirt for distribution in various vicinities. The tractors also will be used for moving the railroad's grouting machines, which are used for stabilizing the roadbed in the more inundated areas.

Falk Appoints Dave S. Ferree

DAVE S. FERREE was recently appointed District Manager of the new Philadelphia sales office of The Falk Corporation. His territory includes the Pennsylvania and Delaware areas formerly handled by Martell and Ferree and the York, Pennsylvania area, which was managed by the late John Ericson.



THIS FACTORY IS TOO SMALL

To Completely Satisfy Present Unprecedented User Demand

EVEN THOUGH . . . since the end of the war . . . Cummins have:

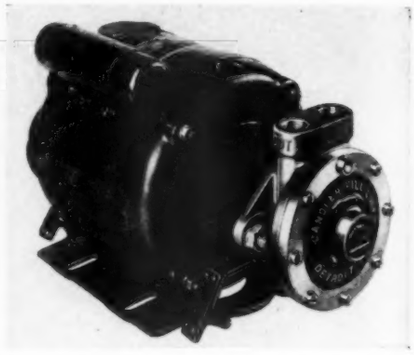
- spent three million dollars ($3,000,000) expanding their plant;
- increased floor space forty-four and eight-tenths per cent (44.8%).

BUT . . . this factory IS large enough:

- to build most of the Diesel Engines for the tough "premium" jobs;
- to assure users that Cummins quality and dependability will not be sacrificed to gain production volume.

CUMMINS ENGINE COMPANY, INC., COLUMBUS, INDIANA

New Titan Pump



New Titan pump direct mounted to the end bell of an electric motor.

CANDLER-HILL Corporation, Division of Titan Pump and Engineering Corporation, recently announced the addition of another Titan pump to its line of fuel, lubricating and water pumps. This new model, No. 4702, has been developed to satisfy an increasing need for a pump to handle a variety of liquids in the medium flow and pressure field where quiet, service-free life is a prime requirement.

The rotating impeller is designed to "hydraulically float" in the housing. Thus, long life operation is assured as there is no metal to metal contact between the rotating and stationary parts. Pumping water at room temperature, the capacity of the standard production unit at 0 psi. discharge pressure is approximately 100 gph. When the discharge flow is completely restricted, the "shut-off" pressure is approximately 200 psi.

The above performance requires a shaft speed of 3450 rpm.—either direct or belt driven. For special applications requiring less than 50 psi. discharge pressure and a maximum of 25 gph. flow, a standard 1725 rpm. motor will be satisfactory.

New Booklet on Batteries for Railway Cars and Diesel Locomotives

DESCRIPTION of various types of Exide-Ironclad batteries for air-conditioning and car-lighting of railroad passenger cars and for engine starting on Diesel locomotives is contained in a booklet recently issued by The Electric Storage Battery Company. The booklet is illustrated with curves and photographs containing technical data of practical use to railroad men. A copy can be obtained by addressing: Railway Department, The Electric Storage Battery Company, Philadelphia 32, Penna.

Superior Engine Division to Celebrate 60th Anniversary in 1948

PLANS are under way for observance in 1948 of the 60th anniversary of The National Supply Company's Superior Engine Division plant at Springfield, O. An Observance Committee, consisting of W. F. Tiemann, works manager; Robert M. Pearson, manager of sales; George F. Noltein, chief engineer; George F. Wells, plant controller; and Herman Houston, of the sales department, has been appointed.

The Superior engine plant grew from a small machine and repair shop established by P. J. Shouvlin in Springfield in 1888. Many of the first Shouvlin engines, which operated on natural gas, were used for drilling and pumping in the North Lima oil field then at its peak. At that time Ohio was producing one-fifth of the world's oil.

The rise of the automobile industry, coupled with the discovery and exploitation of other oil fields, led to steady expansion of the Springfield plant. Manufacture of a line of low-compression semi-Diesel oil engines was begun there in 1920, and the firm subsequently purchased the Otto Engine Works, Philadelphia, to move into Diesel engine production. Later in the 1920's, the Diesel engine industry in the United States grew away from European designs, and Superior engines since then have developed along lines best suited to American conditions and engineering practice.

Tentative plans for the 60th anniversary observance at Springfield call for visits to the plant by editors of prominent business and industrial magazines, Diesel engineering professors of leading universities, representatives of oil companies and other industries, and public officials.

Toth Joins Sheppard Diesel

GEORGE TOTH, formerly District Sales Engineer for the Socony-Vacuum Oil Company in North and South Carolina, has joined the sales staff of the R. H. Sheppard Company. Mr. Toth has been assigned to the southern sales territory covered formerly by Ed MacFarland who will be transferred to the Eastern and New England area.

Order Your Copy of the 1947 DIESEL ENGINE CATALOG now for shipment early in August. Thoroughly revised—more complete — indispensable. Convenient order coupon on Page 95 this issue. Mail it today.

Mexico City To Buy Diesel Generating Plants

UNITED STATES manufacturers and suppliers may be interested in an opportunity to sell small Diesel generating plants for use in Mexico's Federal District.

It is understood that an unspecified number of such plants, each having a capacity of 1,000 kw., are to be purchased to relieve the shortage of current in certain sections of the city.

Quotations on these requirements should be made to the purchasing officer, Emilio Aleman Quijano, Jefe de Compras, Palacio del Gogierno, Pza. de la Constitucion, Mexico, D. F.

Trucking Convention To Be Held In Los Angeles October 26-30

FROM October 26th through the 30th, Los Angeles will be host to the biggest convention in the trucking industry—The convention of the American Trucking Association. The association's executive committee has voted to hold the 1948 convention in Washington, D. C. and will commemorate the 50th anniversary of the trucking industry, and the 15th anniversary of the A.T.A.

New Battery Connector Saves Time

DESIGNED to facilitate battery changing, particularly in heavy duty trucks and buses, is the new "Bus-K-Nect" manufactured by the Scintilla Magneto Division of the Bendix Aviation Corporation. The "Bus-K-Nect" consists of a moulded junction box of high impact material accommodating three terminals in a compact arrangement. It may be mounted on the vehicle frame. When changing batteries it is only necessary to release the cover device and disengage the terminals from the connector contacts, thus avoiding the need for tools. Since with "Bus-K-Nect," cables are not removed from the battery terminals every time a change is made, terminal life is much lengthened. The new connector when tested carried 2700 amps at 12 volts with no damage. For further information write the Scintilla Magneto Division, Bendix Aviation Corporation, Sidney, New York.

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SKF to Spend Four Million On Expansion

SKF Industries, Inc., recently announced a two-year modernization and expansion program that will find the ball and roller bearing firm spending more than $4,000,000 to equip its two Philadelphia plants with new machinery capable in some instances of operating from two to six times faster than standardized equipment long used in the anti-friction bearing industry. While the bulk of the expenditures will go for new machinery required in the production of anti-friction bearings, the program, according to Thomas W. Dinlocker, vice president, is aimed primarily at stepping up production of spherical roller bearings.

"It is now possible, for example, to cold-form rollers for spherical bearings, a method which entirely eliminates turning operations," Dinlocker said. "The equipment developed for this particular manufacturing operation not only enables us to increase output but also to effect substantial savings in bearing steel."

Caterpillar Diesels in Locomotives

IN a new booklet, *"Caterpillar" Diesels the Reliable Power for Diesel Electric Locomotives*, Caterpillar Tractor Co. has unfolded some of the many reasons why the 44-ton Diesel electric locomotive has taken a prominent place in railway progress. The 12-page booklet delves into improved engineering features to emphasize the importance of the locomotive to modern yard and branch line operations for switching and terminal service. Graphic charts indicating performance advantages of the "Caterpillar" Diesel D17000 engine, cutaway views of locomotives and actual job scenes are spaced throughout to illustrate the booklet.

Copies may be obtained by writing Caterpillar Tractor Co., Peoria 8, Illinois, requesting Form 10365.

WEST COAST DIESEL NEWS

By FRED M. BURT

EX-CANADIAN Navy 112 ft. x 15 ft. Fairmile boat is being converted into yacht *Stranger 2* by Vancouver Shipyards, Ltd., for Capt. F. Lewis, with two 8 cyl. General Motors Diesels at 500 hp. replacing the gasoline engines, to give an 18 knot speed.

ATLAS Imperial Diesel Engine Co. has opened new headquarters in San Francisco at 512 Brannan St., in charge of J. H. Czock, assisted by John Jones; Ed Dunk in charge of sales and service. With the closing of the old sales office, at this new location the company will have sales office, display room, parts storage, and shop facilities for small engine repair.

JOHN A. CUNEO succeeds Harry W. Brown, retired, as manager of Los Angeles branch of Fairbanks, Morse & Co. Joining the company as a field engineer in 1929, Mr. Cuneo has served as Havana branch manager, assistant manager of export division in New York, and for past two years as member of organizing staff of Fairbanks, Morse de Mexico in Mexico City.

EMIL J. RIUTTA, West Coast Manager for R. H. Sheppard Co., manufacturers of Diesel engines in Hanover, Pa., has opened a West Coast factory branch for the company, at the foot of Hyde St., San Francisco. Jack McCurry is service manager.

COMPLETED by Grandy Boat Co., Seattle, for South Pacific Fisheries, Ltd., Honolulu, new 85 ft. purse-seine type fishing vessel *Tongareva* is powered with an 8 cyl. 265 hp. Hendy Diesel; auxiliaries are two Caterpillar Diesels.

SMART new tug *Bear Flag*, designed and built by F. L. Fulton, Fulton Shipyard, Antioch, Calif., is powered with twin General Motors, 165 hp. Diesel engines for a speed of 11 knots.

CROFTON Diesel Engine Co., San Diego, has converted three LCVP landing boats for use as pleasure and sport fishing cruisers; they are powered by 220 hp. 8 cyl., General Motors Diesels 71, with 2:1 reduction gears.

MARY LOU, 118 ft. wood tuna vessel just completed at Lynch Shipbuilding Co. yard, San Diego, has a 550 hp. supercharged Atlas Imperial Diesel for propulsion, and a pair of Atlas with 75 kw. G.E. generators for auxiliaries.

SHEPHERD Diesel Marine, Los Angeles, Terminal Island, and San Diego, has been named as exclusive distributor for Hallet 8 and 18 hp. propulsion and auxiliary Diesels, for the territory from Monterey County line south to San Diego and in Lower California.

BUILT by National Iron Wks., San Diego, for Serefino Parmigiani and J. E. Mellusi, the new 106 ft. steel tuna clipper *Mary Barbara,* for main engine has a 550 hp., supercharged Atlas Imperial Diesel; auxiliaries are Atlas Diesels providing 112 hp.

AUSTIN SHERMAN of Hallet Mfg. Co., Inglewood, Calif., recently re-powered his 60 ft. custom-built, Chris-Craft cruiser *Enchantress* with a pair of General Motors Diesels; work done at the Fellows & Stewart yard, Terminal Island.

SAN DIEGO sightseeing steamer *Silvergate,* daily carrying hundreds of tourists, has been repowered at the Star & Crescent Boat Co. with a pair of 200 hp., supercharged Cummins Diesels. Many of the company's shoreboats have been repowered with 6 cyl., 200 hp. General Motors Diesels, mostly with Snow-Nabstedt reverse gears.

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THE ENTIRE DIESEL IND

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Clark Brothers Company
Consolidated Diesel Electric Corporation
Climax Engineering Company
Continental Motors Corporation
Cooper-Bessemer Corporation
Cummins Engine Company

Enterprise Engine & Foundry Company

Fairbanks, Morse & Co.
Fulton Iron Works Company

General Machinery Corp. (Hooven, Owens, Rentschler Division)
General Motors Corporation
Cleveland Diesel Engine Division
Detroit Diesel Engine Division
Electro Motive Division
Gray Marine Motor Company

Hallett Manufacturing Company
Joshua Hendy Iron Works
Hercules Motor Corporation
Hill Diesel Engine Company (Division of Rogers Diesel & Aircraft Corp.)

Ingersoll Rand Company
International Harvester Company

Kahlenberg Brothers Company
Kermath Manufacturing Company

Lathrop Engine Company
Lincoln Diesels (Bolinders Company)
Lister-Blackstone Inc.
Lorimer Diesel Engine Company

Mack Mfg. Corporation
Murphy Diesel Company

National Supply Company (Superior Division)
Nordberg Manufacturing Company

Palmer Bros. Company

Rathbun-Jones Engineering Company
John Reiner Company

R. H. Sheppard Company
Sterling Engine Company
Sun Shipbuilding & Drydock Corporation

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